Oct. 12, 1937. W. G. H. FINCH 2,095,929

ELECTRONIC DISTRIBUTOR

Original Filed Dec. 4, 1935

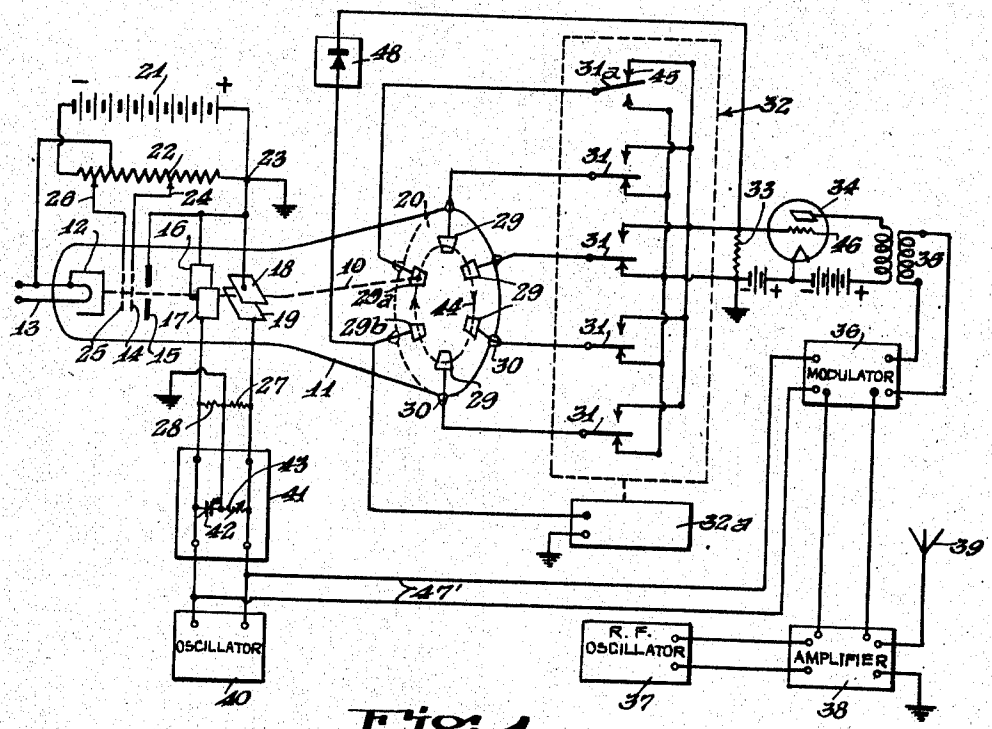


Fig. 1

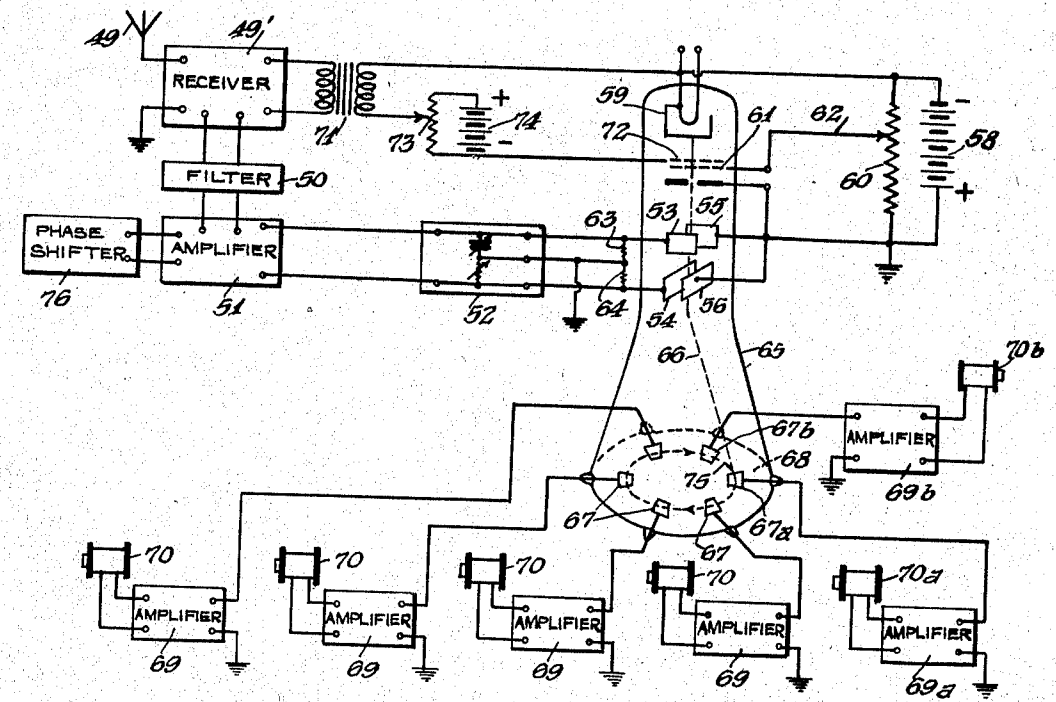


Fig. 2

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Patented Oct. 12, 1937

2,095,929

UNITED STATES PATENT OFFICE

2,095,929

ELECTRONIC DISTRIBUTOR

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Original application December 4, 1935, Serial No. 52,871, now Patent No. 2,057,773. Divided and this application October 8, 1936, Serial No. 104,581

6 Claims. (Cl. 178—66)

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

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 predetermined combinations of holes for the characters. It is the practice to pass the tape through apparatus having 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 accordingly the main object of my present invention to eliminate the mechanical distributor and substitute therefor an electronic distributor. The electron beam of a cathode ray tube is caused to scan a plurality of metallic plates or targets corresponding to the individual contacts of a mechanical distributor. The substitution of an inertialess selector 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 similar to that of the transmitter which selects the transmitted code signals to operate standard telegraph printing apparatus.

Although the mechanical distributor for the printing telegraph receiver of my present invention is most suited for speeding up the operation of translation of the signals, it is evident that it may similarly be employed with a transmitter involving mechanical selection of the signal impulses corresponding to the signal groups set in the punched signal tape. A mechanical distributing system at the transmitter end to produce the successive coded signal impulses corresponding to the 5-unit character code plus one unit for the printing and resetting operation will naturally slow up the operation of the system as a whole. However, the electronic distributor corresponding to my present invention, when used at the receiver, will avoid the sparking, wear and other difficulties that the mechanical distributors inherently are subjected to, to improve the operation and maintenance of the printing telegraph receiving station. However, I prefer to employ the electronic distributor of my invention in conjunction with electronic distributors at the transmitting station for obtaining a high word rate of transmission. Preferred electronic transmitter distributors are shown and described in the parent case, Patent No. 2,057,773, dated October 20, 1936, in connection with Figures 1, 3 and 5, minor details of which may be altered to correspond to the requirements of the present embodiment for the receiver.

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 distributors in signalling systems.

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

These and other objects of my invention will become apparent in the following description in connection with the drawing, in which:—

Figure 1 is a schematic illustration of a transmitting telegraphy system employing an electronic distributor according to my invention.

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

Although the electronic printing telegraph receiver may be employed with different types of transmitters an electronic transmitter is preferable to maintain the highest over-all speed of transmission. The transmitter is illustrated in Figure 1. The electron beam 10 is produced in a highly evacuated vessel 11. The generation of the electron beam is familiar to those skilled in the electronic art and is schematically shown. 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 and 18 are connected to the grounded high potential point 23 to assume the same potential as the anode 15. The plates 17 and 19 are connected to ground through high resistances 27 and 28 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.

On the back face 20 of the tube 11, I arrange a plurality of metallic plates or targets 29 within the tube. As illustrated in Figure 1, these plates 29 are spaced around a circle within the tube 11 and have connections projecting through the tube at points 30. Five of the metallic electrodes 29 are connected to corresponding contactors 31 of a selector mechanism 32. In modern printing telegraphy, a message tape is employed which has a succession of holes punched according to a predetermined code. The commonly used Baudot code, for example, employs combinations of five units to correspond to individual letters or symbols. The punched tape is passed through a selector mechanism which has five feelers which coact with the tape and operate contactors 31 as is well known in the art. I have schematically illustrated such a selector mechanism at 32.

The contacts of the contactors 31 are connected in parallel across the input circuit 33 of a thermionic amplifier stage 34. The output 35 of the amplifier 34 is connected to a modulator 36 for modulating a radio frequency carrier produced by the radio frequency oscillator 37 connected to the radio frequency amplifier 38 to be transmitted for radio transmission by the antenna 39.

A local oscillator 40 is connected to the electrostatic deflecting plates 17 and 19 through a rotator circuit 41 comprising a condenser 42 and resistance 43 connected as shown. The impedance of the condenser 42 is adjusted to be substantially equal to the resistance 43 at the frequency of the local oscillator 40. The electron beam 10 will be moved in a circular path as is well known in the art. The diameter of this circular path 44 at the end 20 of the tube 11 depends upon the voltage output of the oscillator 40 which is adjusted so that the diameter of the path 44 coincides with the mean diameter of the circularly arranged plates 29. There is thus provided means for successively scanning the electrodes 29 at a predetermined rate.

When the electron beam 10 impinges on a target 29, the electrons will be conducted to ground through its corresponding contactor 31 if it is not actuated by its selector feeler, but connects to the lower contact. However, if a feeler of the selector mechanism 32 at that time projects through a hole in the perforated tape, an arm of the corresponding contactor, for example, 31*a*, will be moved to connect to its upper contact point 45 and the electrons of beam 10 impinging on the corresponding target 29*a* will be conductively connected to the grid 46 of the thermionic amplifier 34. The electrons of the beam 10 are attached to ground since the high potential side of its accelerating battery source 21 is connected to ground. The electrons of the beam 10 accordingly pass to ground through the input circuit or grid resistor 33. The electrons flowing through the grid resistor 33 produce a potential change upon the grid 46. A corresponding impulse is transmitted through the amplifier 34 to its output 35. Accordingly, while the electron beam 10 is passing over an electrode 29 having its corresponding contactor 31 actuated by a selector feeler projecting into a hole in the perforated tape, electrons will be conducted to the input circuit 33 of the amplifier 34 and produce a pulse or signal therethrough. This pulse or signal is introduced to the modulator 36 for radio transmission as described.

The operation of the electronic distributor according to my invention therefore is to cause an electron beam 10 to successively scan a plurality of metallic target electrodes 29 arranged at the far end of the evacuated envelope 11. The electrodes 29 are connected to individual contactors 31 of a selector mechanism 32 of a perforated tape telegraphy system. Each contactor 31 and its corresponding electrode 29 correspond to a predetermined component of the five unit code of the perforated tape. With each symbol group punched in the tape, a corresponding arrangement of contactors 31 will be actuated to their upper contacts during the transmission of the code group. The frequency of the oscillator 40 is adjusted so that it successively scans all the electrodes 29 once for each code group advanced through the selector mechanism 32. Each contactor 31 actuated by a hole in the perforated tape conductively connects its corresponding electrode 29 to the grid 46 of the amplifier 34, and a signal pulse will be produced by the amplifier 34 when the electron beam 10 passes over this target 29. Accordingly, a succession of signal pulses is transmitted corresponding to the code group on the perforated tape being presented to the mechanical feelers in the selector mechanism.

The selecting mechanism feeds the perforated tape at a predetermined rate in accordance with the frequency of scanning of the electrodes 29 and each code group is retained by the selector pins during the execution of each cycle of scanning. The electron beam will therefore be conductively connected to the grid 46 of the amplifier 34 as it successively scans the electrodes 29 in accordance with the code group being transmitted. The oscillator 40 is connected to the modulator 36 by leads 47. The radio frequency carrier wave which is radiated by antenna 39 is modulated by the signal impulses and by the scanning frequency. The purpose of transmitting the scanning frequency from oscillator 40 is to provide accurate synchronization for the electronic distributor at the receiver.

The advancement of the perforated message tape, through the selector mechanism 32 is synchronized with the scanning movements of the electron beam 10 over the targets 29. The tape is retained in the selector mechanism during the scanning operation of a code group and is advanced to the next code group at the end of each cycle. The actuating means for the stepping of the tape through the selector mechanism is preferably an electro-magnetically operated pawl and ratchet arrangement schematically shown as 32*a*. I provide a sixth target electrode 29*b*, which is connected directly to the stepping mechanism 32*a*. A signal amplifier is included in the electro-magnetic unit 32*a* to sufficiently amplify the impulse to operate the mechanical stepping means. The electrode 29*b* sets off the five signal targets 29 into one group. At the end of a code group transmission, therefore, the electrode 29*b* is impinged by beam 10 and the electromagnetically operated stepping mechanism automatically advances the message tape to the next code group to be transmitted. The cycle is then repeated. The rate of transmission of the code groups is accordingly predetermined

by adjusting the frequency of the oscillator 40, the number of groups transmitted per second being equal to the generated cycles per second of the oscillator 40.

The target 29b is also connected to the input circuit 33 of the signal impulse amplifier 34 through a unidirectional impedance device 48. 48 may be a buffer stage of thermionic amplification, or a rectifier. A unidirectional impedance 48 is used to transmit an electron beam 10 impulse at target 29b to the signal amplifier 34, but to prevent any signal impulses from other targets from reaching the stepping amplifier 32a. The stepping mechanism 32a will therefore be actuated only by the impulses on target 29b for proper action thereof. The impression of the impulse of target 29b upon the signal amplifier 34 is to transmit, at the end of each cycle, an impulse to be utilized at the receiver as a "printing impulse". The function of the "printing impulse" will be described hereinafter in connection with the receiver printing mechanism.

In Figure 2, is illustrated a receiver system employing an electronic distributor. The antenna 49 is connected to the radio receiver 49' which detects and amplifies the telegraphy signals. A filter 50 is connected to the audio circuit of the receiver 49 and is tuned to pass the scanning frequency generated at the transmitter by the oscillator 40. The output of the filter 50 is introduced to an amplifier 51 which is connected to the electro-static deflecting plates 53 and 54 through the rotator circuit 52. Their corresponding deflecting plates 55 and 56 are 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.

The receiver electronic distributor 65 is of similar construction to that of the transmitter of Figure 1. An electronic beam 66 is produced and caused to scan a plurality of metallic electrodes or targets 67 arranged in a circular path on the back wall 68 of the evacuated envelope. The targets 67 are individually connected to amplifiers 69 at the outputs of which are connected relays 70. There are five relays 70 which are used to operate a local printing telegraph. The rectified unidirectional output of the receiver 49 is connected to the primary of transformer 71 the secondary of which is impressed across the grid 72, and cathode 59. The grid 72 bias potential is adjusted to a suitable negative value by the potentiometer 73 connected across the grid biasing battery 74.

The synchronizing frequency impressed across the electrodes 53 and 54 through the rotator circuit 52 produces a rotation of the electron beam 56. The voltage output of the amplifier 51 is preferably adjusted to produce a path diameter 75 of the electron beam 66 about equal to the mean diameter of the circularly arranged targets 67. The operating potentials of the electrodes are adjusted so that the beam 66 will be properly focused to impinge upon the targets 67 when a signal impulse is impressed upon the grid 72. The bias of the grid 72 is adjusted so that when no signal impulse is transmitted through the transformer 71, it will be sufficiently negative to throttle the electron beam 66 and prevent it from reaching the electrodes 67. Accordingly, the electron beam 66 moves in the circular path 75 at a predetermined rate equal to the rate of beam 10 at the transmitter. In the embodiment of Figure 2, the signal impulses will bring the electron beam 66 into proper focus upon the electrodes 67, but during "no signal" the negative potential of the grid will be such as to throttle the beam 66 to prevent its reaching the electrode 67. When the electron beam 66 impinges upon a target 67, a pulse is introduced to the input of the corresponding amplifier 69. The production of the pulse by the electron beam 66 at the amplifier 69 input is the same as the production of the signal impulse introduced at the grid 46 of the amplifier 34 of Figure 1 described hereinabove. The amplifiers 69 are made sufficiently sensitive to suitably energize the corresponding relays 70 for actuating the local printing mechanism.

The phase of the alternating current scanning signal filtered at 50 and introduced to the amplifier 51 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 targets at the transmitter in order to properly maintain the code combinations at the printing mechanism. Accordingly, when the electron beam 10 of the transmitter impinges on the electrode 29a, the receiver electron beam 66 will impinge upon the corresponding electrode 67a to actuate the printing relay 78a, in proper sequence. 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 which are selected by the mechanism 32 of the transmitter according to the coded perforations in the tape passing therethrough.

A sixth target 67b is included in the target group of the receiver electronic distributor 65, and corresponds to the target 29b at the transmitter. A "printing impulse" is transmitted at the end of each code group as hereinabove described, corresponding to the 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 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 the telegraphy systems which use mechanical distributors.

I claim:

1. In a printing telegraph system, means for receiving successive groups of coded substantially uniform intensity signal impulses corresponding to transmitted characters; an electronic distributor for said signal impulses comprising means for generating an electron beam, a plurality of target electrodes spacedly arranged in a fixed path, means for normally moving said beam at a predetermined rate in the region of said target

electrode path, and means for selectively impinging said beam upon an individual target electrode in response to a signal impulse; and relay units individually connected to each of said targets, responsive to the impinging of the beam upon the targets and being capable of being actuated once per code group to select a local printing character corresponding to the transmitted character in accordance with the particular combination of targets impinged by the beam during the associated group signal reception.

2. In a printing telegraph system, means for receiving successive groups of coded substantially uniform intensity signal impulses corresponding to transmitted characters; an electronic distributor for said signal impulses comprising means for generating an electron beam, a plurality of target electrodes spacedly arranged in a fixed path, means for normally moving said beam at a predetermined rate in the region of said target electrode path, and means for selectively impinging said beam upon an individual target electrode in response to a signal impulse; and relay units individually connected to each of said targets, responsive to the impinging of the beam upon the targets and being capable of being actuated once per code group to select a local printing character corresponding to the transmitted character in accordance with the particular combination of targets impinged by the beam during the associated group signal reception, one of said relay units being connected to a predetermined target electrode and responsive to a cyclic signal impulse for operating the printing and resetting of the local characters between the reception of each successive signal group.

3. In a printing telegraph system, means for receiving successive groups of coded substantially uniform intensity signal impulses corresponding to transmitted characters; an electronic distributor for said signal impulses comprising means for generating an electron beam, a plurality of target electrodes spacedly arranged in a circular path, means for normally moving said beam at a predetermined rate in the region of said target electrode path, means for adjusting the relative phase position of the movement of said beam with respect to said target electrodes, and means for selectively impinging said beam upon an individual target electrode in response to a signal impulse; and relay units individually connected to each of said targets, responsive to the impinging of the beam upon the targets and being capable of being actuated once per code group to select a local printing character corresponding to the transmitted character in accordance with the particular combination of targets impinged by the beam during the associated group signal reception.

4. In a printing telegraph system, means for receiving successive groups of coded substantially uniform intensity signal impulses corresponding to transmitted characters; an electronic distributor for said signal impulses comprising means for generating an electron beam, a plurality of target electrodes spacedly arranged in a fixed path, means for normally moving said beam at a predetermined rate in the region of said target electrode path, means for adjusting the relative phase position of the movement of said beam with respect to said target electrodes, so that a predetermined target is reached by the beam at the end of each signal group reception, and means for selectively impinging said beam upon an individual target electrode in response to a signal impulse; and relay units individually connected to each of said targets, responsive to the impinging of the beam upon the targets and being capable of being actuated once per code group to select a local printing character corresponding to the transmitted character in accordance with the particular combination of targets impinged by the beam during the associated group signal reception, one of said relay units being connected to said predetermined target electrode and responsive to a cyclic signal impulse for operating the printing and resetting of the local characters between the reception of each successive signal group.

5. In a printing telegraph system, means for receiving successive groups of coded substantially uniform intensity signal impulses corresponding to transmitted characters; an electronic distributor for said signal impulses comprising means for generating an electron beam, a plurality of target electrodes spacedly arranged in a circular path, means for normally moving said beam at a predetermined rate in the region of said target electrode path, comprising a rotator circuit connected to said distributor and responsive to a received synchronizing frequency current, and means for selectively impinging said beam upon an individual target electrode in response to a signal impulse comprising an electrode for controlling the focusing of said beam upon said target electrodes, connected to the output of said receiving means; and relay units individually connected to each of said targets, responsive to the impinging of the beam upon the targets and being capable of being actuated once per code group to select a local printing character corresponding to the transmitted character in accordance with the particular combination of targets impinged by the beam during the associated group signal reception.

6. In a printing telegraph system, means for receiving successive groups of coded substantially uniform intensity signal impulses corresponding to transmitted characters; an electronic distributor for said signal impulses comprising means for generating an electron beam, a plurality of target electrodes spacedly arranged in a fixed path, means for normally moving said beam at a predetermined rate in the region of said target electrode path, comprising a rotator circuit connected to said distributor and responsive to a received synchronizing frequency current, means for adjusting the relative phase position of the movement of said beam with respect to said target electrodes, so that a predetermined target is reached by the beam at the end of each signal group reception, and means for selectively impinging said beam upon an individual target electrode in response to a signal impulse, comprising an electrode for controlling the focusing of said beam upon said target electrodes, connected to the output of said receiving means; and relay units individually connected to each of said targets, responsive to the impinging of the beam upon the targets and being capable of being actuated once per code group to select a local printing character corresponding to the transmitted character in accordance with the particular combination of targets impinged by the beam during the associated group signal reception, one of said relay units being connected to a predetermined target electrode and responsive to a cyclic signal impulse for operating the printing and resetting of the local characters between the reception of each successive signal group.

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