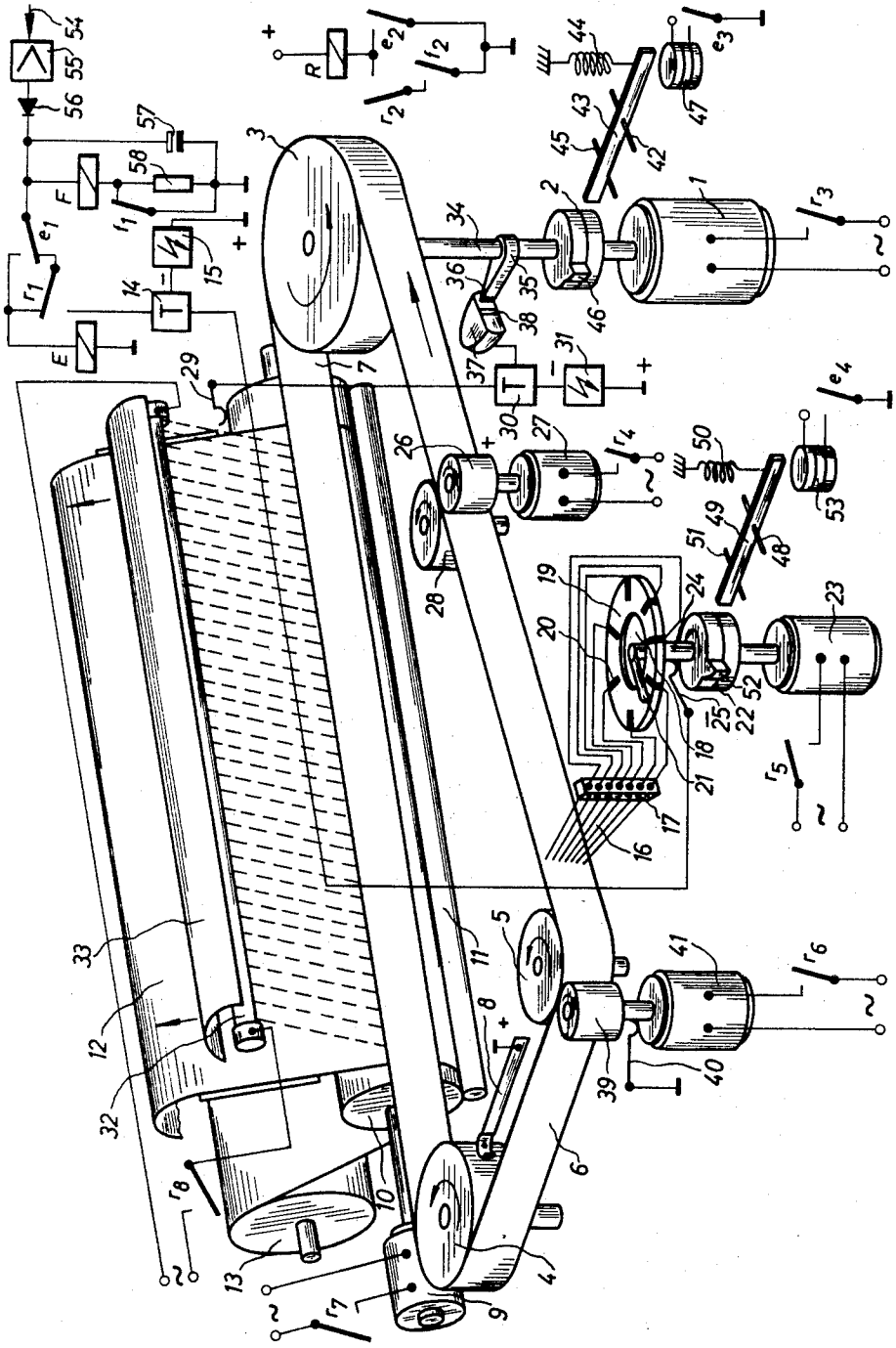
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ELECTROSTATIC TELEGRAPHIC PRINTER

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ELECTROSTATIC TELEGRAPHIC PRINTER

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ABSTRACT OF THE DISCLOSURE

A printing and recording system and apparatus which receives pulse sequences indicative of intelligence and which initially records the intelligence on an endless tape capable of holding an electric charge and which is then dusted with a suitable powder for producing an electric image which is transferred line by line to a paper moving at right angles to the tape in response to an electrical pulse. The electrical charge is then removed from the tape so that new recording may be made on the tape for subsequent transfer to the paper.

The present invention relates to page recording methods for Hell characters using a circulating endless tape serving as an intermediate recording carrier, on which the Hell characters, received in the form of pulse sequences, are continually and successively recorded and are stored at least for the length of one line, the individual stored lines each in its entirety, being subsequently transferred one below the other to a sheet of paper transported vertically to the direction of movement of the tape, and after a stored line has been transferred, the recorded characters of said line being erased from the tape. The invention also relates to apparatus for carrying out the method.

In the Siemens-Hell method of teletyping, which constitutes an intermediate stage between the start-stop method of teletyping with type bar and pure facsimile telegraphy, a character is keyed manually or by machine (operating with perforated strips) at the transmitter end and one of 47 stored pulse sequences, which correspond to 47 different characters, is transmitted, a pulse sequence of this type corresponding to the breaking-down into columns and lines of a screened Hell standard form rectangular character field into black and white picture elements.

The Hell recorders for Hell pulse sequences of this type for operation with paper strips, are of particular simplicity. A strip receiver of this type comprises a rotating recording helix (recording screw or coil) which is continually dyed by means of a roll of felt soaked in dye, said recording helix having two complete coils of a helix disposed at an angle of 180° with respect to each other. The armature of an electromagnet is constructed with a cutting edge, which extends parallel to the axis of the helix and is located closely opposite said helix, and a continually moving paper strip passes between the helix and the edge, onto which are printed the two points of contact between the two recording coils and the paper, which periodically shift downwards, at each impact of the recording cutting edge. In this manner the Hell characters are recorded doubly one above another, picture point by picture point and column by column. Besides strip receivers there also exist Hell page recorders. In these devices the recording coil is replaced by a ribbed roller, the straight ribs of which extend in the direction of the line and are of the length of a written line. Instead of one recording edge, three are provided, and these are secured to an endless circulating chain and are led along the ribs in such a manner that when an edge reaches the end of a line the next edge is at the beginning of the next line. A dye tape is located between the ribbed roller and the recording edge and the sheet of paper, onto which the characters are recorded picture point by picture point in successive columns, is introduced between the dye tape and the ribbed roller, vertically to the axis of the roller.

The transmitter operates with a binary five-digit perforated strip. During operation without line synchronization, the last character is recorded simultaneously at the end of one line and at the beginning of the following line, regardless of the endings of words or division of syllables. This double recording at the end and beginning of lines and also the indiscriminate breaking-off in the middle of a word are rather disturbing to the reader. In order to avoid this disadvantage the rest of the line after the end of a last word or syllable is filled in by filling pulses which are not recorded. The next line then begins immediately at the beginning of a line with the next word or next syllable. In this case precautions must be taken so that all page recording devices connected to a Hell transmitter commence recording with the same character exactly at the beginning of a line. For this purpose a control device operating in synchronization with the perforated strip transmitter is required at the transmitter end. During manufacture of the transmitter-end perforated strip certain measures must be taken for this purpose, e.g., the stamping of particular perforation combinations for line synchronization, since the Hell page recorder does not include double recording of characters.

The advantages of the Siemens-Hell teletyping method are that the transmission is not very liable to interference by signal distortions and, in the case of strip operation, that it is not necessary to synchronize the transmitter and receiver, for while in the case of start-stop teletyping operations with a type bar, a character transmitted in binary five-digit code is completely distorted if interference during transmission causes the loss or addition of even a single pulse of a five-digit combination, in the case of the Siemens-Hell process the discriminated recording means that the legibility of a character is hardly affected by the loss or addition of individual picture points.

In strip operation the double recording results in the text always being legible, even when transmitter and receivers are not synchronized, since when characters incline upwardly or downwardly on the recording paper strip, one recording is always continued by a second recording where the first stops and vice versa. The Siemens-Hell method is thus admirably suited for wireless communication on short waves, whose liability to interference by frequent fading is well known.

The disadvantages of this method lie in the low recording rate of 5 characters per second as compared with the rate of 7.14 characters per second in the start-stop teletyper method and in the greater bandwidth requirements of 122.5 c./s. (245 bauds) as against 25 c./s. (50 bauds) in the start-stop teletyper. Since in commercial connections the page recording method is preferred, the relatively complicated page recorder receiver with its ribbed roller and synchronization accessories is at an added disadvantage as compared with the infinitely simpler strip receiver.

In order to obviate these disadvantages it has been suggested that the known Hell recording system with recording helix and recording cutting edge be used for a page recorder in such a manner that the page introduced between the recording helix and the recording cutter be conveyed in relation to both members in two directions perpendicular to one another, namely in the direction of the line, thus perpendicular to the axis of the helix, and in the direction of travel, thus parallel to the axis of the helix.

Although the possibility of considerably increasing the recording speed of a page recorder of the type mentioned by decreasing the inertia of the recording cutter armature

so that pulse frequencies of approximately 1200 c./s. (2400 bauds) could still be perfectly recorded, have tended considerably to intensify development research, all attempts to use the Hell strip-recording method in the manner described for a page recording device have so far been of no avail. This is due both to the difficulty of perfectly guiding the recording paper, which is continuously or intermittently supplied from a roll, between the recording helix and the recording cutter and maintaining it in continuous movement and to the great inertia of the carriage transporting the roll of paper, and also to the constructional difficulties encountered when it is attempted to make possible the movement of the recording components (helix and recording cutter), which are separated from each other by the recording paper, in two directions perpendicular to each other.

A page recorder for facsimile transmissions is also known wherein the pulses transmitted, which are produced by the photoelectric scanning at the transmitter end of the picture points of the character or line drawing original to be transmitted, are continuously and successively recorded in the form of picture points on a circulating endless tape serving as an intermediate recording carrier and are stored at least for the length of one line, the individual stored lines being subsequently transferred each in its entirety and one below the other by means of an intermittently operating printing mechanism on to a sheet of paper transported vertically to the direction of movement of the tape end, after a stored line has been transferred, the recorded characters of this line are erased from the tape.

For recording purposes a simple system is here provided which, when a magnet is excited, successively records picture points in line direction. The use of the circulating endless tape as an intermediate recording carrier, the recordings of which are periodically transferred to the sheet of paper line by line, obviates the difficulties in connection with the inertia of the large masses to be moved (carriage with paper storage roll) at high recording speeds. In contrast to the Hell strip recorder however, the picture points are not recorded above one another in adjacent columns but adjacent one another in lines above one another, so that a facsimile page recorder of this type cannot be used in conjunction with a Hell transmitter.

In order to make this type of combination possible, a special modified Hell transmitter has been produced which uses magnetic storage of the picture points of the Hell characters of each complete line in a storage matrix in order to render possible the keying and transmission of the pulses corresponding to the picture points line by line instead of column by column. The column pulse sequences of the individual successive Hell characters of a line of characters are thus transformed as it were into line pulse sequences, so that the above-mentioned special Hell transmitter may be used in conjunction with the abovementioned facsimile page recorder.

Even if the known special Hell transmitter and facsimile page recorder allow for high transmission and recording speeds of approximately one line of printing per second, the transmitter is nonetheless extremely costly so that it would seem desirable to have available a page recorder for Hell characters firstly allowing for an even greater recording speed of approximately 10 lines of printing per second and secondly adapted to be operated in conjunction with a normal Hell transmitter. Any further increase in the recording speed is however limited by the inertia of the electromechanical components, in particular the recording cutter armature, so that no further increase in recording speed should be expected of electromechanical recording systems.

There are, however, prospects of a considerable increase in recording speed where the known inertialess electrographic recording method is used.

According to the invention, the recording of the Hell characters is effected by means of a novel use of the known facsimile page recorder with circulating tape used as an intermediate recording carrier, the invention consisting in that at the recording location, charges are sprayed on the tape in the form of points or dots, below one another, and in adjacent columns, this being effected by means of a system of five to seven needle electrodes arranged at equal distances in a plane which is almost perpendicular to the direction of travel of the tape, parallel to one another and directly in front of said tape, said needle electrodes being periodically successively connected, by means of a distributing switch, to a high voltage source gated on and off by the Hell pulses received, in that behind the recording location (as seen in the direction of travel of the tape) the charged band is dusted with a xerographic powder of opposite polarity, and that periodically each time a dusted section of tape with a recorded complete picture line arrives in front of the recording paper, the powder picture is drawn from the tape on to the paper by means of the electrostatic attraction of a pulsed constant homogeneous electrostatic field produced between the paper carrying roll provided with an electrically conductive surface and a counter electrode of at least the length of a line located opposite said roller, through which field both tape and paper move, the powder picture there being fixed by means of the effect of heat, and that finally behind the transfer location (as seen in the direction of travel of the tape) but in front of the recording location, the tape is discharged and cleaned of remaining adhering particles of powder.

The continuous operation of the page recorder according to the invention necessitates machine keying of the characters, thus use of the perforated strip method, at the transmitter end in order to avoid gaps in the recording and to attain high speeds of transmission, which require photoelectrical scanning of the perforated strips. Because of the known ambiguity of the binary five-digit teletyping code, the teletyping symbol of which is only made clear by using one of the two initial operational symbols "letter" and "cipher," which causes a loss of time, an unambiguous six-digit code is used for the coding of the characters in a binary code. The six-digit code perforated strip is produced by means of a device known as a type perforator, wherein a perforated strip is produced simultaneously with the typing of the message to be transmitted on to a sheet of paper, using a typewriter.

Since transferring of the lines of printing from the strip to the sheet of paper can only be effected periodically because of the continuous operation of the page recorder, the same amount of time must always be available for the transmission and recording of a line of printing, even when it is incomplete, as is required for the transfer operation. A complete printed line consists of a maximum of 69 characters. In order to give the transfer mechanism time to complete its operation, a 70th space is left at the end of each (complete) printed line which does not cause a character to be recorded but causes, in the receiver, a pause of the length of time necessary for a character to be recorded.

A separate perforation combination must be provided for the spaces between words and for the spaces to be inset at the beginning of a line, as well as for the empty spaces to be added at the end of a line in order to complete an incomplete printed line; this perforation combination produces, at the receiver, a blank pulse sequence of a duration equal to the time required for a character to be recorded.

The scanned perforation combinations of the transmitter are converted by means of an electronic converter from the binary six-digit code into the Hell code, known devices being provided for this purpose. The converter must operate in such a manner that when the six-digit combinations are fed into the input of the converter at a regular rhythm, the Hell pulse sequences corresponding

to the six-digit combinations appear at a regular rhythm at its output.

When a rectangular Hell character field is screened into five to seven lines and five columns, with the addition of two side margins for the spaces between characters—thus into 35 to 49 picture elements—and assuming a speed of transmission of 10 printed lines per second, approximately $10 \times 70 \times 50 = 35000$ pulses per second are transmitted (35000 baud). This corresponds to a picture point frequency of 17500 c./s. and requires a band width which is also 17500 c./s. This is thus considerably larger than in the case of known Hell recorders. Only carrier frequency lines or radio channels can therefore be used for transmission.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawing which shows a perspective view of one embodiment of a picture recorder and block diagram of the pertinent basic receiver circuit.

Referring to the drawing, a motor **1** drives a tape drive pulley **3** in the direction of the arrow by means of a slipping clutch **2**. An endless tape **6** is driven in the direction of the arrow at constant speed by means of the pulley **3** and guide pulleys **4** and **5**. The tape **6** consists of an electrically insulating plastic material and is provided on its internal surface with an electrically conductive metal lining **7** which is earthed by the metal guide pulley **4** and a friction contact **8**.

A motor **9** rotates a paper transport roller **10** at a constant speed via a reduction gear which is not shown in the drawing, and the surface of the roller **10** is provided with a metal coating. This roller and the counter-pressure roller **11** cause a sheet of paper **12** supplied from a storage roller **13** to move slowly and continuously in the direction of the arrow. The relationship between the peripheral speeds of the roller **10** and the pulley **3** is so calculated that during the time taken by the tape **6** to move the length of a printed line, the sheet of paper **12** moves a distance equal to the height of the line plus the line spacing. The circumference of the drive pulley **3** is equal to the length of a complete printed line, thus approximately 16 cm.

The recording of the received Hell pulses, which gate a high voltage supplied from a high voltage source **15** in a gating circuit **14** is effected by means of the five to seven needle electrodes **16** which are arranged at equal distances in an almost vertical plane, parallel and above one another, and which are held together in a support **17** of insulating material so as to form a comb with pointed teeth. The distribution of the high voltage pulses released by the received Hell pulses to the five to seven needle electrodes **16**, according to the breaking down of a column of Hell characters into five to seven picture elements, is effected by means of a distributor switch **18**. This consists of a rigid pulley **19** of insulating material into which are inserted five to seven electrically conductive segments **20** at equal distances one from another. The segments are electrically connected to the needle electrode **16**. A rotating wiper **21** is driven in the direction of the arrow by a motor **23** via a slipping clutch **22**. The wiper is mounted on a shaft **24** which is connected by means of a friction contact **25** with the output of the gating circuit **14**. During a single rotation of the wiper **21**, it successively applies to the five to seven needle electrodes **16** pulsed high voltage or no voltage, depending upon whether the gating circuit **14** is opened by the received Hell pulses or not. Instead of the rotating electromechanical distributor described, an electronic distributor may also be used, and this is recommended for higher recording speeds.

Between the metal lining **7** of the tape **6** and whichever of the needle electrodes **16** is under high voltage there exists a pulsed constant electrostatic field. If for example, the electrode **16** is negative and the inner lining of the tape **6** positive, corona discharges cause negative charges to be sprayed on to the side of the tape **6** adjacent the electrode **16**, a picture point being in each case recorded as a charge image.

The characters are recorded on the tape **6** as mirror images from right to left so that the characters transferred to the sheet of paper **12** appear as in the original.

Since during recording of the picture points of a column of characters, the tape **6** continues to move, the characters on the tape slope slightly towards the right and consequently after being transferred to the sheet of paper **12** slope slightly towards the left. In order to avoid this, the plane of the needle electrodes **16** is arranged to slope somewhat to the left.

In order to render the latent charge image visible, it is dusted with a xerographic synthetic resin powder charged at opposite polarity, i.e., is positively charged. The powder thus adheres to the charged places. Dusting is effected, for example, by means of a rotating magnetic brush **26** which is driven by a motor **27**. A counter-pressure roller **28** prevents deviation of the tape **6**. The xerographic powder consists for example of a mixture of fine iron filings and synthetic resin powder. When these are mixed together, the tribo-electrical effect causes the iron filings to be charged negatively and the synthetic resin powder to be charged positively, so that the iron filings hold fast the particles of powder. When dusting is effected by means of the magnetic brush, which essentially consists of a permanent magnet, the negatively charged tape **6** attracts the positively charged particles of synthetic resin to itself and holds these fast, while the iron filings remain adhering to the permanent magnet. Other known devices may be used instead of the known dusting device described, such as for example a rotating brush which is covered with the hairs of certain animal skins. When the brush rotates the hairs draw particles of powder out of a storage container. Friction causes the hairs and powder particles to be charged with opposite polarity so that the former hold the latter fast. The greater charging of the tape **6** causes the particles of powder to be drawn from the brush on to the tape **6**.

Every time a section of the tape with a dusted complete recording line arrives in front of the sheet of paper **12**, the powder image is instantaneously transferred from the tape **6** to the sheet of paper **12**, and this is ensured by a pulsed constant and homogeneous electrostatic field which is periodically generated between the metal surface of the paper transport roller **10** and the metal lining **7** of the tape **6**. The surface of the roller **10** is connected to the negative pole of a high voltage source **31** via a friction contact **29** and a controllable gating **30**. For every voltage pulse which is released through the gating circuit **30**, the powder image is drawn over from the band **6** on to the sheet of paper **12** in an accurate reproduction of the picture. By means of an infra-red lamp **32**, the heat rays of which are concentrated by a cylindrical reflector **33** on to a narrow area of the sheet of paper **12** of character height, the successively transferred character powder images are fused in and are thus fixed on the paper and made visible.

Since the tape **6** continues to move during the transfer process, a slight smudging of the characters occurs in the direction of the line. The duration of the transfer process is approximately 10μ seconds. With a recording speed of 10 printed lines per second, the tape speed is approximately 1600 mm./sec. Thus, during the transfer time of 10μ seconds, a hardly noticeable smudging represented by a displacement of 0.016 mm. occurs. The same is true of the smudging of the picture points on the tape **6** which occurs during recording by the needle electrodes **16**. The pulse frequency of the received Hell pulses is approximately 35 kc./s., and the pulse interval is thus approximately 30μ seconds. Since however the pulse length is approximately $\frac{1}{3}$ of the pulse interval, thus also approximately 10μ seconds, the same amount of smudging viz. a displacement of 0.016 mm., is caused.

A cam **35** which is secured to a shaft **34** of the pulley

3 serves periodically to release the high voltage pulse, said cam carrying at its pointed end a small wedge-shaped permanent magnet 36, and a pick-up head 37. At every rotation of the cam 35, as the magnet 36 passes the air gap 38 of the pick-up head 37, the magnet 36 induces in the coil of said pick-up head a voltage pulse which, after amplification, opens the gating circuit 30 for a short period and thus releases a high voltage pulse from the generator 31 to the friction contact 29.

After each transference of a line of printing from the tape 6 to the sheet of paper 12, the tape has to be cleaned of any particles of powder adhering thereto and must be discharged. A rotating brush 39 provided with fine metal bristles serves this purpose, said brush being earthed via a friction contact 40 and driven by a motor 41.

A lever 43 mounted to rotate about a shaft 42 serves for phasing the Hell page recorder for releasing in correct phase the high voltage pulses for transferring the powder images from the tape on to the paper before commencement of reception of a transmission, the forward end of said lever being raised in rest position by a spring 44, so that its rear end abuts a support 45 and releases a cam 46 on the upper half of the slipping clutch 2. When the starting signal comes from the transmitter, a magnet 47 is energized and draws the forward end of the lever 43 downwards against the pull of the spring 44. This causes the rear end of the lever 43 to be raised and come to rest in front of the cam 46 so that the shaft 34 is held fast in this phase position. Once the starting signal is terminated, the magnet 47 is de-energized, the front end of the lever 43 drops and releases the cam 46 so that the shaft 34 is driven by the slipping clutch 2.

The angular spacing between the cam 35 in its phase position and the gap 38 of the pick-up head 37—as measured in the direction of rotation—is so calculated that after commencement of reception of a transmission, the gating circuit 30 is opened for the first time when the tape 6 has moved by an amount equal to the quotient obtained when the tape length between the points of the recording electrodes 16 and the left printing edge on the sheet of paper 12—as measured in the direction of the arrow—is divided by the length of the printed line. At the commencement of a recording, the gating circuit 30 is operated freely at least once before the beginning of the recording of the first line has reached the left-hand printing edge of the sheet of paper 12. The number of free operations of the gating stage 30 depends upon the above-mentioned length of the tape and is equal to the quotient produced by dividing the length of the tape by the length of the recording lines and ignoring the remainder.

A lever 49 mounted to rotate about a shaft 48 serves for phasing the Hell page recorder for correct phase positioning of the picture element columns forming the Hell characters before commencement of reception of a transmission, the forward end of said lever being raised in the rest position by a spring 50, so that its rear end abuts a support 51 and releases a cam 52 on the upper half of the slipping clutch 22. When the starting signal comes from the transmitter, a magnet 53 is energized and draws the front end of the lever 49 down against the pull of the spring 50. This causes the rear end of the lever 49 to be raised and come to rest in front of the cam 52 so that the shaft 24, to which the wiper 21 is secured, is held fast in this position. This is the position in which the wiper 21 is located upon whichever segment is connected to the first upper needle electrode. Once the starting signal is terminated, the magnet 53 is de-energized, the lever 49 drops back into rest position and releases the cam 52 so that the shaft 25 and the wiper 21 secured thereon is driven by the slipping clutch 22.

A continuous synchronizing of the Hell page recorder by the transmitter during reception need not be effected if the synchronous motors 1 and 23 which drive the tape 6 and the distributor switch 18 are fed by local tuning fork-stabilized oscillators, as is nowadays conventional practice in picture telegraphy, or when transmitter and receiver motors are driven from the same synchronized alternating current supply.

If there are no stabilized generators for the motors provided in the transmitter and in the receivers, a line synchronization of the receivers by the transmitter can be effected at the end of transmission of each complete printed line, and during the pause available as a result of the 70th character not transmitted, by causing the transmitter to give a line synchronization signal which is utilized in the receivers by means of any known speed regulating device.

The basic receiver circuit is shown at the top right-hand corner of the drawing. The telegraphic pulses received from the transmitter via a long distance line 54 are amplified in an amplifier 55 and de-modulated by a rectifier 56. Before commencement of transmission, the transmitter gives the starting signal in the form of a continuous tone of about 1 second's duration, in order to switch on the receiver motors and to phase the starting positions of the gating circuits 30 and 14. A receiver relay E and an operating relay R are provided for this purpose. A switching-off relay F serves to switch off the receiver. The starting signal, which is assumed to be of the same amplitude as the telegraphy signal, charges a very high capacity capacitor 57 and switches on the relay F via operating contaft *f*1. This causes the contact *f*1 to open and a rest contact *f*2 in the circuit of the relay R to close. The relay F now receives a smaller current due to the presence of the resistor 58, but is not thereby de-energized. The starting signal passes on to the relay E via the switching contacts *e*1, and *r*1, thus energizing said relay. This causes *e*1 to reverse so that the relay E remains energized and *e*2 closes, thus causing the relay R to be energized. The rest contact *r*2 closes and the relay R remains energized via *r*2 and *f*2: *r*1 also reverses but this has no immediate effect. The starting signal cannot reach the gating circuit 14 since *e*1 is in the upper position. The contacts *e*3 and *e*4 then close, energizing the magnets 47 and 53 and causing the rear ends of the levers 43 and 49 to move into the path of the cams 46 and 52. Finally contacts *r*3, *r*4, *r*5, *r*6, *r*7 and *r*8 close, causing the motors 1, 27, 23, 41 and 9 to start, and switching on the infra-red lamp 32. The cams 46 and 52, driven by the slipping clutch, rotate into the phase positions in which they are held by means of the locking levers 43 and 49.

Upon termination of the starting signal, the end of which causes the transmission from the transmitter of the pulse sequence of the first Hell character to be transmitted, the relay E is de-energized, causing *e*1 to move to the lower position, effecting connection of the gating circuit 14 to the long distance line 39 via the contact *r*1 in its lower position. Then, *e*2 opens, but this does not cause the relay R which is held on *r*2 and *f*2 to become de-energized. Then, *e*3 and *e*4 open, thus de-energizing the magnets 47 and 53 and releasing the cams 46 and 52, so that the tape 6 begins to circulate, and the wiper 21 to rotate. The charge of the capacitor 57 is maintained by the telegraphy pulses.

The receiver is switched off when no telegraphy pulses are received from the transmitter over a period of half a minute. The capacitor 57 the slowly discharges via the large value resistor 58. The time constant of this RC circuit is so calculated that the relay F switches off after about half a minute. This causes *f*1 to close and *f*2 to open. The circuit of the relay R is interrupted, *r*1 moves to the upper position and *r*2, *r*3, *r*4, *r*5, *r*6, *r*7 and *r*8 open, thus switching off all the motors and the infra-red lamps 32. The Hell page recorder is now ready for a new start.

Changes may be made within the scope and spirit of

the appended claims which define what is believed to be new and desired to have protected by Letters Patent.

I claim:

1. An apparatus for the page-recording of characters received in the form of pulse sequences, wherein received impulses are to be stored temporarily on a recording medium for at least the length of one line, and the individual stored lines are to be reproduced one below the other on recording paper comprising, an endless tape forming an intermediate recording carrier of a length to store the length of at least one line to be recorded, means for continuously circulating said tape, paper transport means for moving a sheet of paper adjacent said tape in a direction perpendicular to the direction of the adjacent tape for the transfer of a line of characters from the tape to said paper sheet, a plurality of needle electrodes arranged closely adjacent the tape at the recording location, said needles being equally spaced and extending parallel to one another in a plane extending transverse to the direction of travel of the tape, means including a distributor operatively connected to said electrodes for periodically and successively connecting a source of high voltage thereto, receiving means to which said pulse sequences are supplied connected to the distributor for selectively controlling the application of pulse sequences to said distributor, said electrodes being operative to apply corresponding electrostatic charges on said tape, said charges being in the form of dots below each other in adjacent columns, means for applying xerographic powder which bears a charge of opposite polarity to the charges on said carrier to the charged portions of the latter, means disposed adjacent the recording paper sheet in said transporting means for periodically creating an electrostatic attraction whereby a complete dusted recording line on said tape is instantaneously transferred from the carrier to the paper, means for directing heat on a line of recording transferred to said paper to fix such line, and means disposed adjacent said tape at a point to receive said tape following its movement across the paper sheet and for discharging any charge remaining on the tape and cleaning the latter of any remaining adhering particles of powder.

2. An apparatus as defined in claim 1, wherein said paper transport means includes a roller and said means for forming an electrostatic attraction at said paper comprises an electrically conductive surface formed on said roller and a counter electrode located opposite said roller for at least the length of a line, forming, upon the application of a voltage thereto, a field through which both said tape and paper move.

3. An apparatus as defined in claim 2, wherein five needle electrodes are utilized.

4. An apparatus as defined in claim 2, wherein seven needle electrodes are employed.

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