March 29, 1960 S. METZGER 2,930,847

PRINTER

Filed Nov. 1, 1956 3 Sheets-Sheet 1

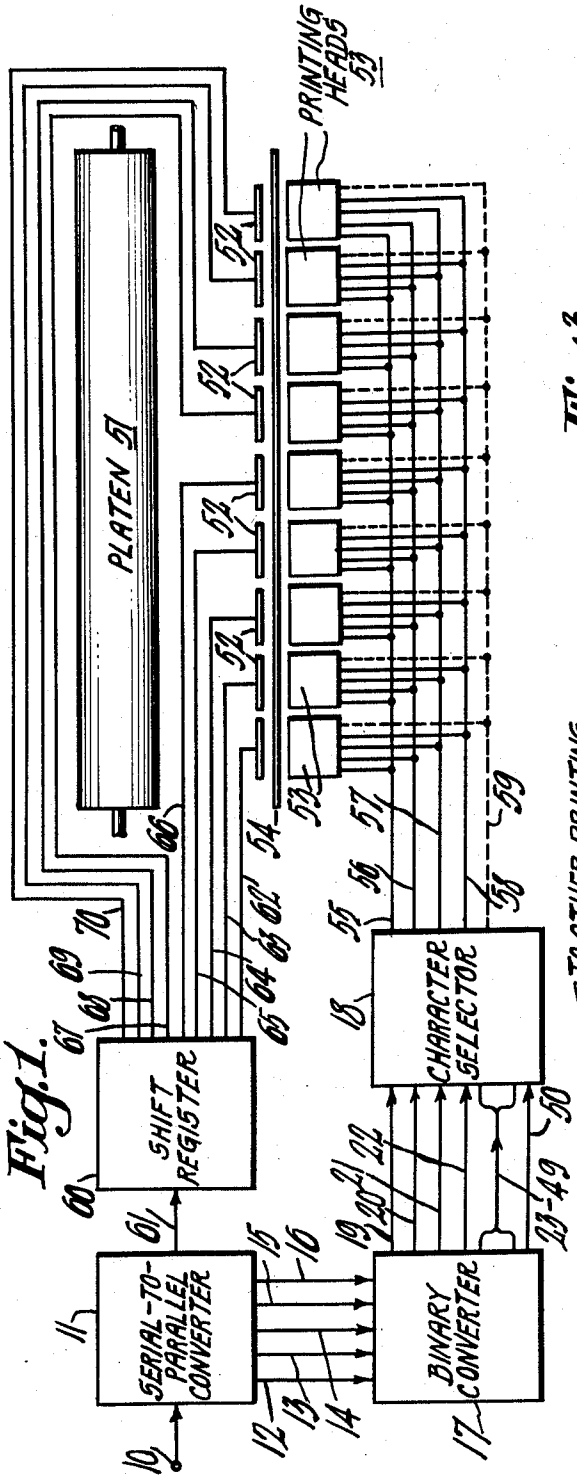

Fig. 1.

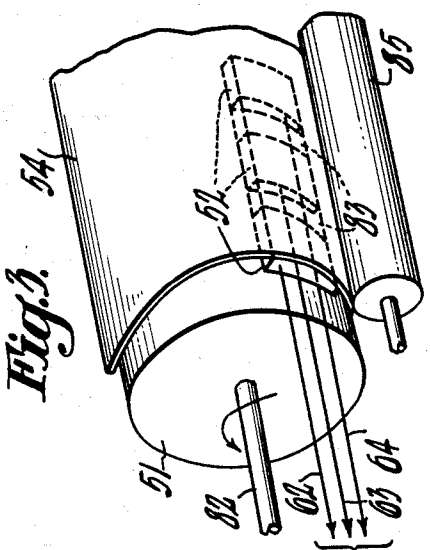

Fig. 3.

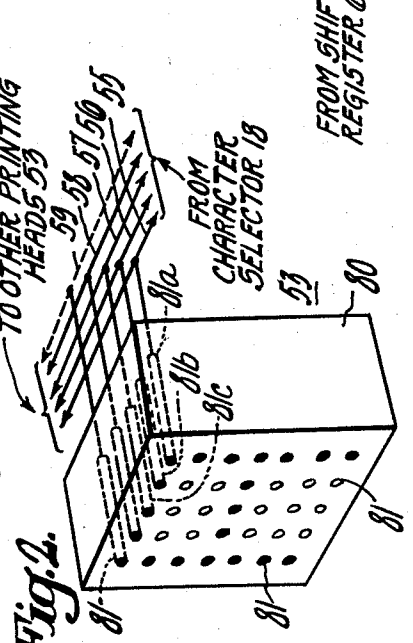

Fig. 2.

INVENTOR.
Sidney Metzger
BY
Charles H. Brown
ATTORNEY

March 29, 1960 S. METZGER 2,930,847

PRINTER

Filed Nov. 1, 1956 3 Sheets-Sheet 2

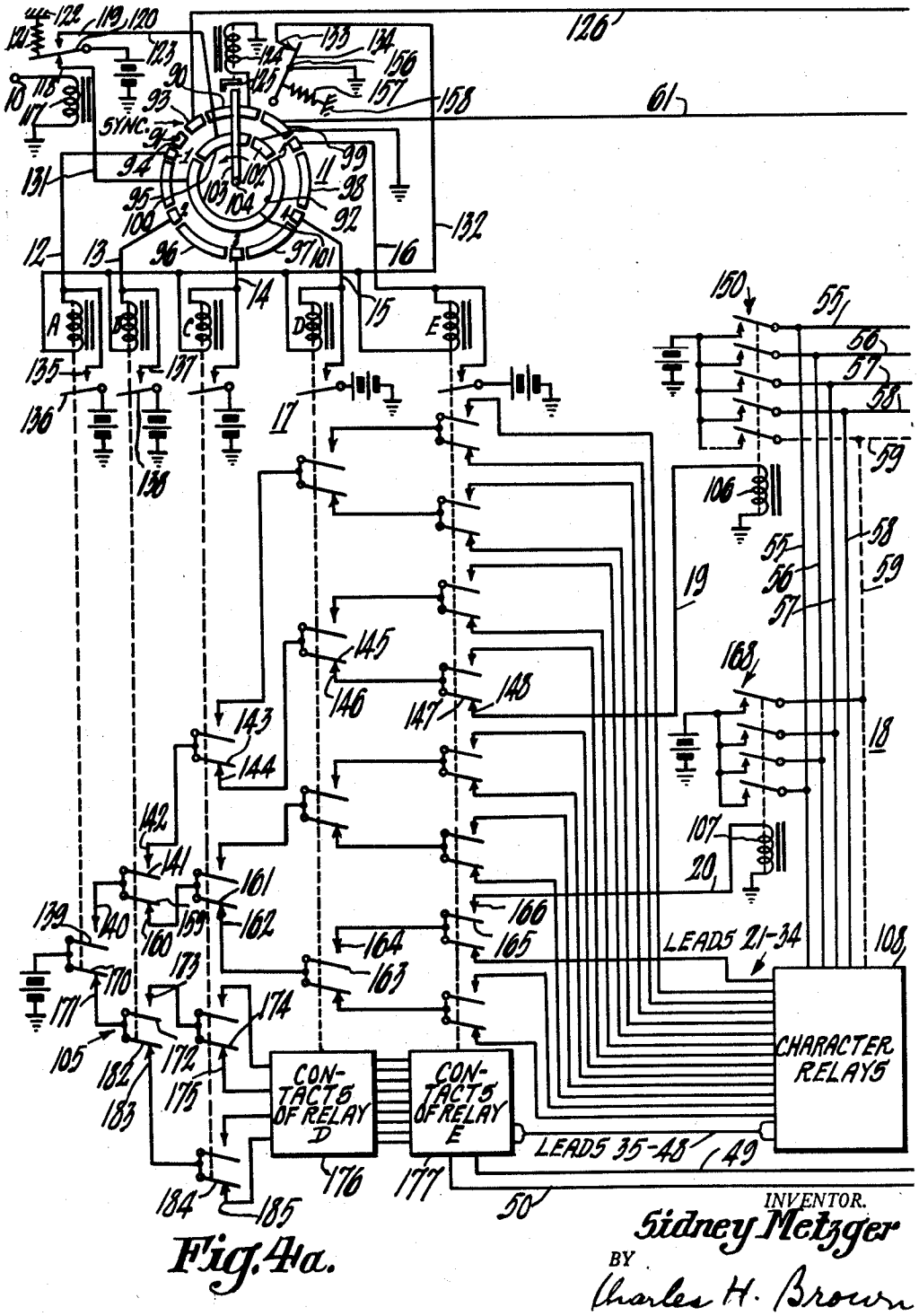

Fig. 4a.

INVENTOR.
Sidney Metzger
BY
Charles H. Brown
ATTORNEY

March 29, 1960 S. METZGER 2,930,847

PRINTER

Filed Nov. 1, 1956 3 Sheets-Sheet 3

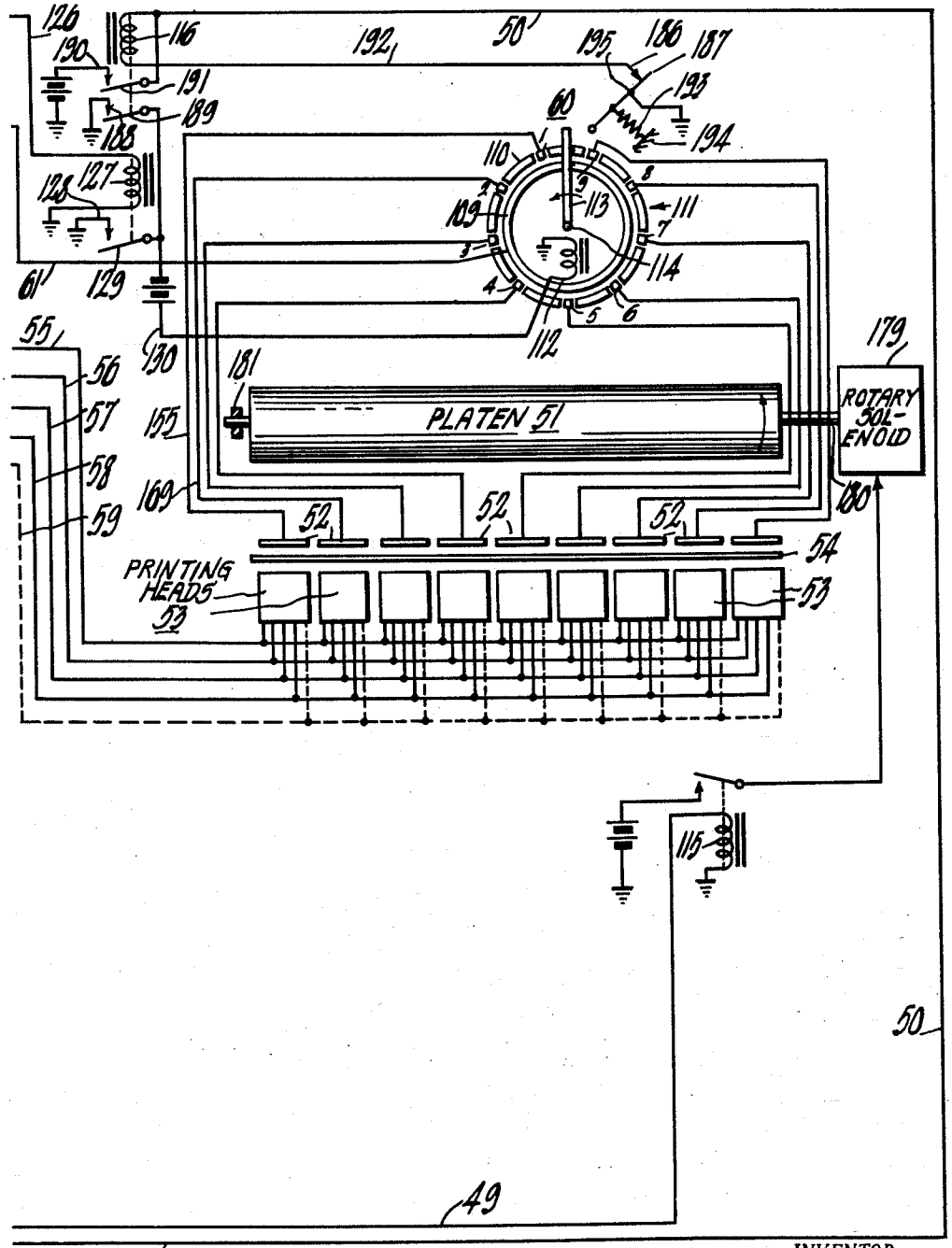

Fig. 4b.

INVENTOR.
Sidney Metzger
BY
Charles H. Brown
ATTORNEY

United States Patent Office 2,930,847
Patented Mar. 29, 1960

2,930,847

PRINTER

Sidney Metzger, Princeton, N.J., assignor to Radio Corporation of America, a corporation of Delaware

Application November 1, 1956, Serial No. 619,739

15 Claims. (Cl. 178—23)

The invention relates to printers. More particularly, the invention relates to an electronically operated page printer capable of high speeds of operation.

Present page printers, for example, teletypewriter machines, are mainly of two types. In one type, the carriage or platen included in the printer is made to shift from one position to the next for each character printed on a line. In a second type, the carriage is held in a stationary position, and a type box is made to shift from one position to the next along the carriage for each character printed on a line. The satisfactory operation of both types of printers requires the use of complex, mechanical switching procedures to cause either the carriage or type box to shift at the correct time and in the proper manner. Because of the time required to complete the necessary switching procedures, the printers described are limited in operation to about sixty or one hundred words per minute. In order to achieve substantial increases in the speed of operation, it is necessary to reduce the mass of moving parts presently required or eliminate them entirely.

It is an object of the invention to provide an improved page printer capable of higher speeds of operation than can be achieved by the page printers now known.

A further object is to provide an improved page printer in which functions previously performed by mechanical equipment are performed by electronic equipment, thereby greatly increasing the speed of operation of the page printer over that achieved by the page printers now known.

A still further object is to provide an electronically operated page printer of improved design capable of high speeds of operation.

Briefly, a metal backing plate is positioned between a paper or printable element upon which characters are to be printed line-by-line and the surface of a platen or roller. The plate extends along the longitudinal axis of the platen and is shaped so as to permit the positioning of a surface of the plate adjacent to an angular section of the platen's surface, the paper being made to pass over the opposite surface of the plate. The plate is divided into a number of conducting segments which are insulated from one another, the dimensions of each segment being equal to those of the characters to be printed on a line. A number of electronically operated printing or recording heads are arranged in a row along the length of the backing plate such that one of the printing heads is located adjacent each of the segments. The paper is made to pass between the row of printing heads and the segmented backing plate.

When a character of an incoming telegraph signal, for example, is received, the character is converted into control signals which are simultaneously applied to each of the printing heads. An electrical condition is established in each of the printing heads corresponding to the character received. Following the reception of the character and the establishment of the electrical condition corresponding thereto in each of the printing heads,

a ground connection is completed to a single one of the segments. An electrical path is completed including the segment to which the ground connection has been completed and the particular printing head located adjacent thereto. As a result, the character is, for example, electrostatically printed on the section of paper positioned between the segment and the printing head. When a second character is received, an electrical condition corresponding to the received character is established in each of the printing heads. A ground connection is now completed to the next or a second segment of the backing plate, and the second character is electrostatically printed on the paper next to the first printed character. The above circuit operations continue such that, as the characters in an incoming signal are received, the characters are printed in a line across the paper. A feature of the invention is the fact that, while an electrical condition corresponding to a received character is established in each of the printing heads, the character is printed only by the operation of the printing head located adjacent the segment of the backing plate to which a ground connection is completed. By sequentially completing a ground connection to the segments of the backing plate in accordance with the rate at which the characters are being received, the characters will be printed on a line across the paper.

When the last character to be accommodated on a line has been received and printed, as indicated by the reception of the control function characters carriage return and line feed, the platen is operated to cause the paper to move up a line. Clean or unprinted paper appears between the segmented backing plate and the row of printing heads. When the next character is received, a ground connection is completed to the first segment of the backing plate at the left hand margin of the paper and the character is printed as the first character on the new line. As additional characters are received, a ground connection is completed to the remaining segments of the backing plate in turn, causing the characters to be printed on a line across the paper. The reception of a complete message by the page printer merely involves a repetition of the circuit operations described. As the actual printing of the characters received is accomplished electronically by the page printer, the operation involving no moving parts, the page printer of the invention is capable of high speeds of operation.

A more complete description of the invention will be given in connection with the accompanying drawing, in which;

Figure 1 is a block diagram of a page printer constructed according to the invention;

Figure 2 is a physical view of one of the printing heads included in the page printer of the invention;

Figure 3 is a physical view of a section of the platen included in the page printer of the invention, showing the manner in which the segmented backing plate is positioned between the paper and the surface of the platen; and

Figures *4a*, *4b*, taken together, constitute a circuit diagram of one embodiment of a page printer constructed according to the invention and shown in the block diagram given in Figure 1.

Referring to Figure 1, an incoming signal including serially appearing, fixed-length telegraph code characters is applied to an input terminal **10**. It will be assumed that the signal applied to input terminal **10** includes code characters of the five unit fixed-length telegraph code. However, as will be discussed, the incoming signal may include code characters of any fixed-length telegraph code. The incoming signal is applied from the terminal **10** to a serial-to-parallel converter **11**. The serial-to-parallel converter **11** functions as an extensor circuit. The five signal

elements in a code character received serially in time by the converter 11 are changed into a condition in which the signal elements appear individually over separate circuits or output leads 12 through 16. The signal elements are individually applied from the converter 11 to a binary converter 17 over the leads 12 through 16. The binary converter 17 is responsive to the arrangement of signal elements in the code character to apply a control signal to a character selector 18 over one of the leads 19 through 50. The characters in the five unit telegraph code include either five marking elements, five spacing elements or a combination of marking and spacing elements arranged as a five unit code character. As is known in the art, thirty-two combinations of marking and spacing elements are possible and are used in the five unit telegraph code. The binary converter 17 is, therefore, connected to the character selector 18 by means of the thirty-two leads 19 through 50. The reception of the arrangement of signal elements in a particular code character by the binary converter 17 causes a control signal to be applied from the binary converter 17 over a corresponding one of the leads 19 through 50. For example, the binary converter 17 functions in response to each reception of the arrangement of signal elements representing the letter character A to apply a control signal to the character selector 18 over lead 19. Each reception of the arrangement of signal elements representing the letter character B by the binary converter 17 results in the application of a control signal from the binary converter 17 to the character selector 18 over lead 20, and so on.

The page printer of the invention includes a roller or platen 51. A row of segments 52 constructed of a conducting material and constituting a metal backing plate is positioned along the longitudinal axis of the platen 51. The manner in which the row of segments 52 is positioned in relation to the platen 51 will be more fully described in connection with Figure 3. The dimensions of each of the segments 52 correspond to the dimensions of the characters to be printed on a line by the page printer. A row of printing heads 53 is positioned in parallel with the row of segments 52 such that a printing head 53 is located adjacent each of the segments 52. The paper or printable element 54 upon which the characters are to be printed line-by-line is made to pass between the row of segments 52 and the row of printing heads 53.

As will be described more fully in connection with Figure 2, each of the printing heads 53 includes a number of electrodes or conductors arranged in a matrix. The first electrode in each printing head 53 is connected to a lead 55, the second electrode in each printing head 53 is connected to a second lead 56, the third electrode in each printing head 53 is connected to a third lead 57, and so on. Each printing head 53 may include, for example, thirty-five electrodes. While only the connections between the first five electrodes in each of the printing heads 53 and the respective leads 55 through 59 have been shown in Figure 1 in the interest of brevity, the remaining electrodes in each of the printing heads 53 will be connected to additional leads in the same manner, as represented by the dotted lead 59 and the dotted leads connecting each of the printing heads 53 thereto.

When a control signal corresponding to a received code character is applied from the binary converter 17 to the character selector 18 over one of the leads 19 through 50, the character selector 18 functions to apply voltages over certain of the leads 55 through 59. The manner in which the voltages are applied over leads 55 through 59 will be determnied according to the character received, and is different for each of the various characters to be printed by the operation of the printing heads 53. Voltages are applied to the electrodes in each of the printing heads 53 connected to the respective leads 55 through 59 to which a voltage has been applied by the operation of the character selector 18. As a result, an electrical condition corresponding to the character received is established in each of the printing heads 53. In effect, the selective application of voltages to the electrodes in the respective printing heads 53 causes an image of the character to be set up in the matrix of each of the printing heads 53.

Following the reception of a code character by the serial-to-parallel converter 11 and the establishment of an electrical condition corresponding thereto in each of the printing heads 53, a control signal is applied from the serial-to-parallel converter 11 to a shift register 60 over lead 61. The shift register 60 is connected to each of the segments 52 included in the backing plate over separate leads 62 through 70. The shift register 60 functions as a distributor and causes a ground connection to be switched from one of the segments 52 to the next along the row of segments 52 upon the reception of each control signal from the serial-to-parallel converter 11. Assuming for the moment that the first code character in an incoming signal has been received and is to be printed at the left hand margin of the paper 54, the shift register 60 functions in response to the control signal applied thereto from the serial-to-parallel converter 11 to complete a ground connection to the first segment 52 located adjacent the left hand side of the platen 51 and paper 54 over lead 62. An electrical path is completed between the first segment 52 and the printing head 53 located adjacent thereto. The electrical path is completed between the electrodes included in the printing head 53 to which voltage has been applied by the operation of the character selector 18 and the first segment 52. The character received is, for example, electrostatically printed at the left hand margin of the paper 54. While an electrical condition corresponding to the received character is established in each of the printing heads 53, the character is printed only by the operation of the printing head 53 located adjacent the segment 52 to which a ground connection has been completed by the operation of the shift register 60.

Upon the reception of a second code character, an electrical condition corresponding to the second code character is established in each of the printing heads 53. The shift register 60 functions in response to the control signal applied thereto from the serial-to-parallel converter 11 to complete the ground connection to the second segment 52 from the left along the row of segments 52 in the backing plate. As a result the second character is printed next to the previously printed character along a line on the paper 54. As each additional code character is received and an electrical condition corresponding thereto established in each of the printing heads 53, the shift register 60 will function to complete the ground connection to the respective segments 52 in turn from left to right along the row thereof. The characters will be printed on a line across the width of the paper 54. When the last character to be accommodated on a line, as indicated by the reception of the control function characters carriage return and line feed, has been printed by the page printer, the platen 51 is operated to move the paper 54 up a line. In printing the last character on the line, the shift register 60 functions to complete the ground connection to the last or exreme right hand segment 52 over lead 70. The shift register 60 at this time completes a full cycle of operation. When the next code character is received, the shift register 60 functions to complete a ground connection to the first segment 52 located adjacent the left hand margin of the paper 54. The character is printed as the first character on the new line. As additional code characters are received, the circuit operations will continue in the manner described. While a limited number of segments 52 and printing heads 53 are shown in Figure 1 in the interest of simplification and clarity of illustration, the number of segments 52 and corresponding printing heads 53 used may be determined according to a particular application.

A more detailed view of a printing head 53 used in

the page printer is shown in Figure 2. The printing head 53 comprises a block-like member 80 which may be, for example, rectangular in shape. The member 80 is constructed of a non-conducting material, for example, a plastic material many examples of which are known in the art. A plurality of electrodes or conductors 81 are positioned in the member 80 and are arranged in a matrix. In the embodiment shown in Figure 2, the electrodes 81 are arranged in seven lines of five electrodes each. The electrodes 81 are positioned in the member 80 equidistant from one another. One end of each of the electrodes 81 is positioned flush with a surface of the member 80, the other end of each of the electrodes 81 being connected to one of the leads 55 through 59. The electrode 81*a* is connected to lead 55, electrode 81*b* is connected to lead 56, electrode 81*c* is connected to lead 57, and so on. While only the connections between the first line of electrodes 81 and leads 55 through 59 have been shown, the remaining electrodes 81 are individually connected to additional leads in the same manner, the additional leads being represented by the dotted lead 59. The correspondingly positioned electrodes in each of the additional printing heads 53 used in the page printer are connected to leads 55 through 59 in exactly the same manner as are the electrodes 81 of the printing head 53 shown in Figure 2. Thus, the electrode corresponding to the electrode 81*a* in each of the printing heads 53 is connected to lead 55, the electrode corresponding to the electrode 81*b* in each of the printing heads 53 is connected to lead 56 and so on.

When the character selector 18 functions to selectively apply voltages to the leads 55 through 59 according to the control signal applied thereto from the binary converter 17 over one of the leads 19 through 50, an electrical condition corresponding to the received character is set up in the electrode matrix of each of the printing heads 53. For example, when the letter character A is received, the character selector 18 functions to apply voltages to the respective leads of leads 55 through 59 which are connected to the shaded electrodes 81 shown in Figure 2, no voltage being applied to the remaining leads of leads 55 through 59 which are connected to the unshaded electrodes 81. The shaded electrodes 81, to which voltage has been applied, form, in effect, an outline of the letter character A. Assuming that a ground connection is completed to the particular segment 52 located adjacent the printing head 53 shown in Figure 2, the letter character A will be electrostatically printed on the paper 54. The character selector 18 functions to selectively apply voltages over leads 55 through 59 in a manner determined according to the code character received and, therefore, the control signal applied thereto from the binary converter 17 over one of the leads 19 through 50. As a result, voltages are applied to the same arrangement of electrodes in each of the printing heads 53, and an outline of the received code character is, in effect, set up in the electrode matrix of each of the printing heads 53. A more detailed description of the operation of the printing head 53 and character selector 18 will be given in connection with the circuit diagram of an embodiment of the invention shown in Figures 4*a* and 4*b*.

Figure 3 is a view of a section of the platen or roller 51 used in the page printer, and shows the manner in which the row of segments 52 is positioned in relation to the surface of the platen 51. The platen 51 is mounted on a shaft 82. The shaft 82 is mechanically connected to a suitable driving device, not shown, such that the platen 51 can be made to complete a given angle of rotation in response to each operation of the driving device. The segments 52 are arranged in a row along the longitudinal axis of the platen 51. The surface of each of the segments 52 adjacent the surface of the platen 51 is preferably curved to conform with the angular curvature of the surface of the platen 51. The paper or page 54 is made to pass over the opposite surface of the segments 52. The paper 54 can be fed from a storage roll in a manner known in the art. Many arrangements for maintaining the necessary tension in the paper 54 and for controlling the feeding thereof around the platen 51 and row of segments 52, as by the use of sprockets or by friction means such as an idle roller 85, are known and can be used in association with the page printer of the invention. The segments 52 are not secured to the surface of the platen, but are mounted in a stationary position such that the platen 51 is permitted to rotate thereunder.

In order to provide adequate support for the segments 52 in this position, the segments 52 may be connected together to form a solid or continuous backing plate. The segments 52 are insulated from one another by a section 83 of non-conducting material which, in practice, is of a width equal to the spacing permitted between characters printed on the paper 54. A suitable mechanical connection, not shown, can be made to both ends of the segmented backing plate to support the plate in the position shown in Figure 3. For example, the segments 52 and insulating sections 83 could be alternately mounted on a rod of plastic or other non-conducting material secured at both ends to suitable supporting brackets, not shown, which are, in turn, connected to the frame of the page printer. Many possible arrangements are known and could be used without departing from the spirit of the invention. The segments 52 are connected over separate leads to the shift register 60. As shown in Figure 1, the first three segments 52 shown in the sectional view given in Figure 3 are connected to the shift register 60 over leads 62, 63, 64, respectively. The dimensions of the segments 52 and insulating sections 83 have been exaggerated in relation to the size of the platen 51 for purposes of description. In practice, the dimensions of the segments 52 will correspond to the dimensions of the characters to be printed on a line by the page printer. The dimensions of the segments 52 and, therefore, the dimensions of the printing heads 53 can be varied to meet the requirements of a particular application.

A circuit diagram of an embodiment of the invention is given by way of example only in Figure 4, Figures 4*a* and 4*b* taken together. An incoming telegraph signal is applied from suitable telegraph receiving equipment to input terminal 10. The embodiment of the invention shown in Figure 4 is designed to function in response to a start-stop, five-unit fixed-length telegraph code signal. In the use of this type of telegraph signal, an idle line current or continuous marking signal is applied to input terminal 10 during periods of standby operation. The arrangement of signal elements in each code character is preceded by a start or spacing element and is followed by a stop or marking element. A marking element is defined as an interval of current flow, while a spacing element is defined as an interval of no current flow.

The serial-to-parallel converter 11 which functions in response to the telegraph signal applied to terminal 10 in a manner to be described comprises a pair of segmented rings indicated generally by the reference numerals 91, 92, respectively. One of the rings 92 has a smaller circumference than the second ring 91 and is positioned inside the second ring 91. The second or outer ring 91 comprises, reading in a counterclockwise direction, a start segment 90, sync segment 93, an insulating segment 94, a first signal segment, an insulating segment 95, a second signal segment, an insulating segment 96, a third signal segment, an insulating segment 97, a fourth signal segment, an insulating segment 98, a fifth signal segment and a control segment 99. The other or inner ring 92 comprises three segments 100, 101, 102. A wiper arm 103 is secured at one end to a shaft 104. The shaft 104 is mechanically connected through a slip clutch to a continuously operating motor or driving device of constant speed, not shown. Arrangements for

driving a shaft 104 through a slip clutch at a constant speed are known in the art and need not be described in detail. The shaft 104 is mounted so as to pass through the center of the rings 91, 92, the shaft 104 and, therefore, the wiper arm 103 being driven in a counterclockwise direction as indicated by the direction of the arrow. The wiper arm 103 is secured to the shaft 104 and positioned in relation to the rings 91, 92 such that the wiper arm 103 engages both of the rings 91, 92. As the wiper arm 103 is rotated through its angle of rotation, the wiper arm 103 functions to complete a connection, in turn, between the respective segments of the outer ring 91 and the respective segments of the inner ring 92.

The five signal segments included in the outer ring 91 each correspond to one of the signal elements contained in a telegraph code character received. Each of the signal segments is connected over one of the separate leads 12 through 16 to one of five relay devices A through E. The first signal segment is connected to relay A, the second signal segment is connected to relay B and so on. The reception of a marking element causes the operation of the corresponding one of relays A through E. The reception of a spacing element, on the other hand, causes the corresponding one of the relays A through E to remain inoperative. Thus, if all of the five signal elements in a code character received are marking, relays A through E are each operated. If the first signal element is marking and the second, third, fourth and fifth signal elements are spacing, relay A is operated and relays B through E remain inoperative and so on. In any case, relays A through E are selectively operated in accordance with the arrangement of marking and spacing elements included in a received code character such that a condition corresponding to the received code character is established.

Relays A through E are included in the binary converter 17. Contacts of the respective relays A through E are arranged to form a relay tree of conventional design, indicated generally by the reference numerals 105. The construction and operation of relay trees of the type shown in Figure 4 is known and need not be described in detail. Reading from left to right, a normally open set of contacts of relay A is connected to a normally open set of contacts and to a normally closed set of contacts of relay B. A normally closed set of contacts of relay A is connected to a normally open set of contacts and to a normally closed set of contacts of relay B. In much the same manner, each set of contacts of relay B is connected to a normally closed set of contacts and to a normally open set of contacts of relay C and so on. In effect, each of the relays A through E functions to operate twice the number of sets of contacts as are operated by the preceding relay. The relay tree 105 produces a different output signal over a separate output circuit for each possible condition established by the selective operation of relays A through E. As thirty-two combinations of marking and spacing elements are possible in the five-unit telegraph code, the relay tree 105 functions in response to the establishment of a condition corresponding to a received code character by the selective operation of relays A through E to produce one of thirty-two possible output signals over one of the separate output circuits, leads 19 through 50.

The respective output circuits of the relay tree 105 represented by the leads 19 through 50 are individually connected to relays 106 through 108 included in the character selector 18 and to control function relays 115, 116. A different relay is assigned to each character in the five-unit telegraph code. When the relay tree 105 functions upon the reception of a code character to apply an output signal over one of the separate output circuits thereof, the particular relay connected to that output circuit is operated. For the sake of brevity only two of the relays 106, 107 included in the character selector 18 have been shown in detail, the remaining relays included in the character selector 18 being indicated by the block 108. It is to be understood, however, that the construction and operation of the remaining relays 108 is similar to that of the relays 106, 107 shown. Each of the relays 106 through 108 includes a plurality of contacts connected between battery and the respective leads 55 through 59. The relays 106 through 108 include different numbers of contacts connected to various ones of the leads 55 through 59 according to the character to be printed. Thus, assuming that the letter character A is to be printed by the operation of relay 106, contacts of relay 106 connected between battery and leads 55 through 58, as well as between battery and various others of the leads represented by lead 59, are operated. Voltages are applied over the leads 55 through 59 to an arrangement of the electrodes in each of the printing heads 53 such that an electrical condition corresponding to the letter character A is established in the electrode matrix in each of the printing heads 53. In much the same manner, one of the character relays 108 may include contacts connected between battery and lead 57, as well as between battery and various others of the leads represented by lead 59. Voltages are applied over the leads 57, 59 such that an electrical condition corresponding to the character to be printed is established in the electrode matrix in each of the printing heads 53. The operation of each of the relays 106 through 108, therefore, causes an electrical condition corresponding to the code character assigned to a relay placed in operation to be established in the electrode matrix of each of the printing heads 53.

The shift register 60 is in the form of an electromagnetically operated stepping switch, indicated generally by the reference numerals 111, comprising an inner ring 109 and a segmented outer ring 110. A wiper arm 113 is secured at one end to a shaft 114 and is arranged to be rotated step-by-step in a counterclockwise direction, as indicated by the arrow, upon each operation of the switch 111. The outer ring 110 includes a plurality of segments, numbered one to nine, corresponding in number to the number of segments 52 in the backing plate. Insulating segments are located between each pair of succeeding numbered segments. Each of the numbered segments of ring 110 is individually connected to one of the segments 52 of the backing plate. The wiper arm 113 is arranged to engage both of the rings 110, 109 such that, as the wiper arm 113 is rotated through its angle of rotation, a connection is completed, in turn, between the numbered segments included in the outer ring 110 and the inner ring 109.

When a code character is received by the serial-to-parallel converter 11, the operate winding 112 is energized in a manner to be described. The wiper arm 113 is made to step one position, completing a connection between one of the numbered segments included in the outer ring 110 and the inner ring 109. Upon the reception of the complete code character, a ground connection is completed, also in a manner to be described, to the inner ring 109 and, therefore, to the particular segment 52 of the backing plate connected to the numbered segment in the outer ring 110 engaged by the wiper arm 113. An electrical path is completed between the segment 52 to which the ground connection has been completed and the printing head 53 located adjacent thereto. The code character received is electrostatically printed on the paper 54 at the position on the paper 54 located between the segment 52 and printing head 53. As each code character is received, the wiper arm 113 is stepped from one numbered segment to the next numbered segment included in the outer ring 110. The separate connections are completed between the respective numbered segments in the outer ring 110 and the respective segments 52 of the backing plate such that the ground connection is completed to first one and then another of the segments 52 reading from left to right along the row thereof. As a result, the code

characters included in an incoming telegraph signal are printed on a line across the paper **54**.

Various types of paper **54** which may be adapted for use with the invention are known in the art. For example, papers known by the trade names Teledeltos and Timefax recording paper may be used. Such papers meet the requirements as to speed of operation and so on. Other papers available in the art may be used without departing from the spirit of the invention.

The operation of the embodiment of the page printer according to the invention shown in Fig. 4 upon the reception of a particular code character will now be described. The circuit operations to be described will be substantially the same upon the reception of other code characters. It will first be assumed that the page printer is in standby operation and is, therefore, in the condition shown in Figure 4. An idle line current or continuous marking signal is applied to terminal **10** causing the winding of relay **117** to be energized. Relay **117** includes a pair of contacts **118, 119** and an armature **120**. The armature **120** is mounted so as to be driven between the contacts **118, 119** and is attached at its free end to one end of a mechanical spring **121**. The spring **121** is connected at its other end to a supporting member **122** which may be, in turn, connected to the frame of the page printer. When the winding of relay **117** is energized, armature **120** is pulled against the tension of the spring **121** and into engagement with contact **118**. An electrical path is completed from battery to the segment **101** of the inner ring **92** in the serial-to-parallel converter **11** including armature **120** and contact **118** of relay **117**. As the wiper arm **103** is not at this time engaging the segment **101**, no further circuit operations occur.

It will be assumed that a telegraph signal is applied to terminal **10** and that the first code character in the incoming telegraph signal is the letter character A. The letter character A in the start-stop, five-unit telegraph code includes a start or spacing element, the first and second signal elements as marking elements, the third, fourth and fifth signal elements as spacing elements and a stop or marking element. When the start or spacing element is applied to terminal **10**, the winding of relay **117** is deenergized. The tension in the spring **121** causes armature **120** to disengage contact **118** and to engage contact **119**. An electrical path is completed from battery to ground including armature **120** and contact **119** of relay **117**, lead **123**, segment **100** of the inner ring **92** in the serial-to-parallel converter **11**, wiper arm **103**, start segment **90** of the outer ring **91** in the serial-to-parallel converter **11** and the winding of relay **124**. The term ground, as used in the specification, is to be understood as referring to a point of fixed reference potential. The winding of relay **124** is energized. Relay **124** includes a braking member **125** which is positioned so as to prevent the rotation of the wiper arm **103** through its angle of rotation. As previously mentioned, the wiper arm **103** is connected to a continuously operating driving device through a slip clutch. The braking member **125** functions to hold the wiper arm **103** in the position shown in Figure 4 during periods in which relay **124** is inoperative.

When the winding of relay **124** is energized upon the reception of the start or spacing element, relay **124** is operated to move the braking member **125** out of engagement with the wiper arm **103**. The wiper arm **103** is permitted to begin the rotation thereof in a counterclockwise direction. As the wiper arm **103** continues its rotation, an electrical path is completed from battery to ground including armature **120** and contact **119** of relay **117**, lead **123**, segment **100** of the inner ring **92**, sync segment **93** of the outer ring **91**, lead **126** and the winding of a relay **127**. Relay **127** is operated, and an electrical path is completed from battery to ground including contact **128** and armature **129** of relay **127**, lead **130** and the operate winding **112** of the stepping switch **111**. The stepping switch **111** is operated to cause the wiper arm **113** to advance in a counterclockwise direction to a position in which a connection is completed through the wiper arm **113** between the first numbered segment of the outer ring **110** and the inner ring **109**. As an electrical connection is no longer completed between the start segment **90** of the outer ring **91** and the segment **100** of the inner ring **92**, relay **124** becomes inoperative. The braking member **125** returns to its normal or original position.

The speed of the driving device and, therefore, the speed of rotation of the wiper arm **103** is determined according to the frequency of the incoming telegraph signal. The wiper arm **103** is set to rotate at a constant speed such that the wiper arm **103** will complete a connection between the respective signal segments of the outer ring **91** and the segment **101** of the inner ring **92** during the intervals in which the corresponding signal elements in the letter character A are being applied to the terminal **10**. As mentioned above, the first signal element in the letter character A is a marking element, and relay **117** is operated. When the wiper arm **103** reaches the first signal segment of the outer ring **91**, an electrical path is completed from battery to ground including armature **120** and contact **118** of relay **117**, lead **131**, segment **101** of inner ring **92**, wiper arm **103**, the first signal segment of the outer ring **91**, lead **12**, the winding of relay A, lead **132**, contact **133** and armature **134**. Relay A is operated, and the contacts of relay A included in the relay tree **105** are made to assume the opposite condition from that shown in Figure 4*a*. The normally open contacts of relay A are closed, and the normally closed contacts of relay A are opened. In addition, a locking circuit is completed from battery to ground including contact **135** and armature **136** of relay A, the winding of relay A, lead **132** and contact **133** and armature **134**. Relay A will remain operated following the interruption of the original operating circuit of relay A by the continued rotation of the wiper arm **103**.

The wiper arm **103** continues through its angle of rotation such that an electrical connection is completed between the second signal segment of the outer ring **91** and the segment **101** of the inner ring **92** during the interval in which the second signal element of the letter character A is applied to the terminal **10**. As the second signal element is marking, relay **117** remains operated. An electrical path is completed from battery to ground including armature **120** and contact **118** of relay **117**, lead **131**, segment **101** of the inner ring **92**, wiper arm **103**, the second signal segment of the outer ring **91**, lead **13**, the winding of relay B, lead **132**, contact **133** and armature **134**. Relay B is operated, causing the normally open contacts of relay B in the relay tree **105** to be closed and the normally closed contacts of relay B in the relay tree **105** to be opened. Contact **137** and armature **138** of relay B close to provide a locking circuit for relay B including lead **132**, contact **133** and armature **134**. The wiper arm **103** continues its rotation such that a connection is completed between the third, fourth and fifth signal segments of the outer ring **91**, in turn, during the time intervals in which the third, fourth and fifth signal elements, respectively, in the letter character A are being applied to the terminal **10**.

The third, fourth and fifth signal elements of the letter character A are spacing elements. Relay **117**, therefore, becomes inoperative upon the reception of the third signal element and remains in this condition during the reception of the fourth and fifth signal elements. The tension in the spring **121** causes the armature **120** to disengage contact **118** and to engage contact **119**. Battery is not connected to the segment **101** of the inner ring **92** during the intervals in which the third, fourth and fifth signal elements are received, and, therefore, an electrical path is not completed to the respective windings of the relays C, D and E over the leads **14** through **16**, respectively. Relays C, D and E remain inoperative, and the contacts of relays C, D and E in the relay tree **105** remain in the

condition shown in Figure 4a. An electrical path is completed from battery to ground through the relay tree 105 including armature 139 and contact 140 of relay A, armature 141 and contact 142 of relay B, armature 143 and contact 144 of relay C, armature 145 and contact 146 of relay D, armature 147 and contact 148 of relay E, lead 19 and the winding of relay 106 in the character selector 18. Relay 106 assigned to the letter character A is operated. Contacts of the relay 106, which are indicated generally by the reference numerals 150 and are individually connected between battery and leads 55 through 58, as well as between battery and certain of the other leads represented by lead 59, are operated. Voltages are applied over leads 55 through 59 to the same arrangement of electrodes in each of the printing heads 53. An electrical condition corresponding to the letter character A to be printed is established in the electrode matrix of each of the printing heads 53.

In the meantime, the wiper arm 103 continues its rotation such that a connection is completed between the segment 102 of the inner ring 92 and the control segment 99 of the outer ring 91. An electrical path is completed from ground to battery including segment 102, wiper arm 103, control segment 99, lead 61, inner ring 109 of switch 111, wiper arm 113, the first numbered segment of the outer ring 110 in the switch 111, lead 155, the first segment 52 at the left hand side of the backing plate and the electrodes to which voltages have been applied by the operation of relay 106 in the printing head 53 located adjacent the grounded segment 52. The letter character A is electrostatically printed on the paper 54 as the first character on a line. As the wiper arm 103 continues its rotation following the printing of the letter character A on the paper 54, the free end of the wiper arm 103 comes into slideable contact with the free end of the armature 134. A pad of insulating material may be fixed to the free end of the armature 134 to prevent arcing and so on. The action of the wiper arm 103 against the armature 134 causes the armature 134 to rotate about a pivot point 156 against the tension in a mechanical spring 157 which is connected at one end to the free end of the armature 134. The other end of the spring 157 is connected to a supporting member 158, which may be, in turn, secured to the frame of the page printer.

It will be remembered that contact 133 and armature 134, which are normally closed, are included in the locking circuits of relays A and B. The rotation of the armature 134 about the pivot point 156 by the action of wiper arm 103 causes contact 133 and armature 134 to open momentarily, breaking the locking circuit of relays A and B. Relays A and B become inoperative, and the respective contacts thereof in the relay tree 105 return to their normal condition. The operating circuit for relay 106 is broken, and relay 106 becomes inoperative, removing the electrical condition corresponding to the letter character A from the electrode matrix in each of the printing heads 53. The wiper arm 103 continues its rotation to the position thereof shown in Figure 4a. The reception of the stop or marking element following the five signal elements causes relay 117 to operate. Armature 120 engages contact 118, preventing the completion of the electrical path from battery to the winding of relay 124 through contact 119 and armature 120 of relay 117. Relay 124 remains inoperative, and the braking member 125 functions to prevent further rotation of the wiper arm 103 in the absence of the reception of a subsequent code character.

When the next code character included in the incoming telegraph signal is applied to terminal 10, the serial-to-parallel converter 11 will operate in exactly the same manner described to change the condition of the serially appearing signal elements included in the code character into one in which the signal elements appear in parallel over the separate leads 12 through 16. For example, it will be assumed that the next code character in the incoming telegraph signal is the letter character B. The character B in the five-unit, start-stop telegraph code includes a start or spacing element, the first, fourth and fifth signal elements as marking, the second and third signal elements as spacing and a stop or marking element. Relay 124 is operated upon the reception of the start element preceding the signal elements in the letter character B, and the braking member 125 is moved out of engagement with the wiper arm 103. The wiper arm 103 completes a connection between the sync segment 93 of the outer ring 91 and the segment 100 of the inner ring 92 such that the operate winding 112 of the switch 111 is operated. The operation of the switch 111 causes the wiper arm 113 to advance one step, completing a connection between the second numbered segment of the outer ring 110 and the inner ring 109. The wiper arm 103 continues the rotation thereof, completing a connection between the respective signal segments of the outer ring 91 and the segment 101 of the inner ring 92. Relays A, D and E are operated and are maintained in an operated condition by the locking circuits thereof completed through contacts 133 and armature 134. Relays B and C remain inoperative.

An electrical path is completed from battery to ground through the relay tree 105 including armature 139 and contact 140 of relay A, armature 159 and contact 160 of relay B, armature 161 and contact 162 of relay C, armature 163 and contact 164 of relay D, armature 165 and contact 166 of relay E, lead 20 and the winding of relay 107 in the character selector 18. Relay 107 is operated, and the contacts thereof, indicated generally by the reference numerals 168, connected between battery and leads 55 through 57, as well as between battery and certain of the leads represented by the lead 59, are operated. Voltages are applied over leads 55 through 57 and 59 to the same arrangement of electrodes in each of the printing heads 53. An electrical condition corresponding to the letter character B assigned to the relay 107 is established in the electrode matrix in each of the printing heads 53. The continued rotation of wiper arm 103 causes an electrical path to be completed from ground to battery including segment 102 of the inner ring 92, wiper arm 103, control segment 99 of the outer ring 91, lead 61, the inner ring 109 of switch 111, wiper arm 113, the second numbered segment of outer ring 110 of switch 111, lead 169 and the second segment 52 from the left hand margin of the backing plate. The letter character B is printed on a line next to the letter character A. As the wiper arm 103 completes its rotation contact 133 and armature 134 are opened, interrupting the locking circuit of relays A, D and E. Relays A, D and E become inoperative, and the operating circuit for relay 107 through the relay tree 105 is broken. Relay 107 becomes inoperative. The circuit operations occurring upon the reception of additional code characters are the same as outlined above. In each case one of the relays 106 through 108 in the character selector 18 will be operated, according to the condition established by the selective operation of relays A through E, to establish an electrical condition corresponding to the received code character in the electrode matrix of each of the printing heads 53. The stepping switch 111 in the shift register 60 will be operated step-by-step to complete a ground connection to first one and then another of the segment 52 of the backing plate, reading from left to right.

It will now be assumed that a complete line of code characters has been received and printed on the paper 54 by the operation of the page printer. The end of the line is indicated by the reception of the control function characters carriage return and line feed. The operation of the page printer in response to the reception of the control function character line feed will first be described. The control function character line feed in the start-stop, five-unit telegraph code includes a start or

spacing element, the first, third, fourth and fifth signal elements as spacing, the second signal element as marking and a stop or marking element. Relay B is operated, while relays A, C, D and E remain inoperative. An electrical path is completed from battery to ground including armature **170** and contact **171** of relay A, armature **172** and contact **173** of relay B, armature **174** and contact **175** of relay C, contacts of relay D indicated by the block **176**, contacts of relay E indicated by the block **177**, lead **49** and the winding of relay **115**. The second half of the contacts of relays D and E have been indicated by the blocks **176**, **177**, respectively, in the interests of simplification and clarity of illustration. The contacts in the respective blocks **176**, **177** are the same in construction and operation as the remaining contacts of relays D, E shown in detail thereabove. Block **176** represents eight sets of contacts of relay D, while block **177** represents sixteen sets of contacts of relay E.

Relay **115** is operated, and an electrical path is completed from battery to a rotary solenoid **179**. The platen **51** is mounted on a shaft **180**. The shaft **180** is mechanically connected at one end to the rotary solenoid **179** and is supported at its other end by a suitable supporting member **181** which may be, in turn, connected to the frame of the page printer. The rotary solenoid **179** is operated to rotate the shaft **180** and, therefore, the platen **51** in a clockwise direction, as indicated by arrow, causing the paper **54** to move up a line. Clean copy appears between the segments **52** of the backing plate and the printing heads **53**. It is clear that the incoming telegraph signal may include more than a single control function character line feed such that the lines of code characters printed on the paper **54** are double spaced, triple spaced and so on.

The control function character carriage return in the start-stop, five-unit code includes a start or spacing element, the first, second, third and fifth signal elements as spacing, the fourth signal element as marking and a stop or marking element. When the control function character carriage return is received, therefore, relay D is operated and relays A, B, C and E remain inoperative. An electrical path is completed from battery to ground including armature **170** and contact **171** of relay A, armature **182** and contact **183** of relay B, armature **184** and contact **185** of relay C, contacts of operated relay D represented by the block **176**, contacts of relay E represented by the block **177**, lead **50**, the winding of relay **116**, contact **186** and armature **187**. Relay **116** is operated, and an electrical path is completed from battery to ground including contact **188** and armature **189** of relay **116**, lead **130** and the operate winding **112** of switch **111**. The wiper arm **113** is stepped from its position in which a connection is completed through the wiper arm **113** between the ninth number segment of outer ring **110** and the inner ring **109** to the position thereof shown in Figure *4b*. When the next code character is received, the wiper arm **113** will be stepped to the first numbered segment of the outer ring **110** in the manner already described. The code character received, as well as the subsequent code characters in the incoming telegraph signal will be sequentially printed on the paper **54** on the new line.

A feature of the invention is the use of a circuit arrangement to permit the page printer to begin the printing of characters on a new line in response to the reception of the control function character carriage return even though the total number of characters that can be accommodated on a line have not been printed on the preceding line. For example, it may be desired to start a new paragraph. Further, the page printer may be included in a communication system. A message received from one station may not require all of the character spaces available on the last line of the message. When a message is received from a second station, it is necessary that the new message be started on a new line. The message received from the first station is preferably ended with the control function character carriage return. It will be assumed that only five characters were printed on the last line of the first message and that the wiper arm **113**, therefore, is positioned to complete a connection between the fifth numbered segment of outer ring **110** and the inner ring **109**. Relay **116** is operated upon the reception of the control function character carriage return. The operate winding **112** is energized, and the switch **111** is operated to cause the step-by-step rotation of the wiper arm **113**. When relay **116** is operated, a locking circuit is completed from battery to ground including contact **190** and armature **191** of relay **116**, the winding of relay **116**, lead **192**, contact **186** and armature **187**. Relay **116** remains operated following the reception of the control function character carriage return and, therefore, the interruption of the original operating circuit of relay **116**. Switch **111** will continue to rotate the wiper arm **113** step-by-step. When the wiper arm **113** is advanced from engagement with the ninth numbered segment of the outer ring **110** to the original starting position thereof, the free end of the wiper arm **113** is arranged to slideably engage the free end of armature **187**. As in the case of armature **134**, a pad of insulating material may be fixed to the free end of armature **187** to prevent arcing and so on. A mechanical spring **193** is connected at one end to the free end of armature **187** and at its other end to a supporting member **194** which is, in turn, secured to the frame of the page printer. The action of the wiper arm **113** is to cause the armature **187** to rotate about a pivot point **195** against the tension of spring **193**. Contact **186** and armature **187** open momentarily, breaking the locking circuit of relay **116**. Operate winding **112** is deenergized, and the wiper arm **113** is stopped in the position shown in Figure *4b*. It may be seen that the wiper arm **113** is returned to the starting position thereof regardless of where the wiper arm **113** happens to be positioned upon the reception of the control function character carriage return. The code character following the control function character carriage return will be printed on a new line in every case. Instead of appearing as the last code character in the message received from the first station, the control function character carriage return may be supplied by an operator at the receiving station in order to clear the page printer for the reception of a subsequent message.

While a backing plate consisting of only nine segments **52** has been shown in Figure 4, the number of segments **52** may be varied to meet the requirements of a particular application. For example, telegraph printers are commonly arranged in the art to accommodate sixty-nine or seventy-two characters on a line. Accordingly, the backing plate may be arranged to include sixty-nine or seventy-two segments **52**, respectively, in these applications. The number of printing heads **53** used will correspond to the number of segments **52**, one of the printing heads being located adjacent each of the segments **52**. The outer ring **110** of the stepping switch **111** will include separate segments individually connected to each of the segments **52** used in the backing plate. The operation of the switch **111** will remain the same as described, the wiper arm **113** being operated to complete in a full cycle of operation a number of steps corresponding to the number of segments **52** used.

The embodiment of the invention shown in Figure 4 has been described in connection with the reception of a five-unit, fixed-length telegraph code signal. However, the printer may be adapted to operate equally well in response to a different fixed-length telegraph code signal. For example, if a seven-unit, fixed-length telegraph code signal were used, it would merely be necessary to arrange the outer ring **91** of the serial-to-parallel converter **11** with two additional signal segments. Each of the added signal segments would be individually connected to one of a pair of relays added to the arrangement of relays

A through E in the binary converter **17**. The contacts of the added relays would be arranged in the relay tree **105** such that an electrical path is completed through the relay tree **105** to the proper one of the relays in the character selector **18** for each code character received. In a similar manner, the printer may be adapted to operate in response to any fixed-length telegraph code signal without departing from the spirit of the invention.

The invention is not limited to the particular circuit components shown in Figure 4. Instead of the mechanically operated distributing device shown as included in the serial-to-parallel converter **11**, the serial-to-parallel converter **11** may include, for example, a serial in-parallel out magnetic core extensor circuit known in the art. The relay arrangement shown in the binary converter **17** may be readily replaced by a diode matrix also known in the art. The relays included in the character selector **18** may be replaced by an arrangement of electronically operated gating devices, for example, vacuum tubes, of conventional design. Instead of the electromechanically operated stepping switch **111**, the shift register **60** may include a simple, closed loop magnetic core shift register of the type in which a condition is circulated from output core to output core through the register in response to a train of input or shift signals such as would be supplied over lead **61**. Arrangements such as those described, as well as other arrangements known in the art, may be adapted for use in place of the particular circuit components shown without departing from the spirit of the invention.

A page printer is disclosed which is both fast and reliable in operation. By using electronic equipment in place of mechanical equipment used in known printers, the printer of the invention is capable of greater speeds of operation than can be obtained by using printers now known in the art.

What is claimed is:

1. In combination, a plurality of conducting segments, a plurality of printing heads each positioned adjacent a different one of said segments, means for positioning a printable element between said segments and said printing heads, means for establishing an electrical condition corresponding to a character to be printed in each of said printing heads, and means for selectively completing an electrical circuit including one of said segments and the printing head positioned adjacent thereto such that said character is printed on said element.

2. In combination, a plurality of conducting segments, a plurality of printing heads each positioned adjacent a different one of said segments but spaced therefrom a distance sufficient to permit the passage therebetween of a sheet of printable material, means for positioning a sheet of printable material between said segments and said printing heads, means for establishing an electrical condition corresponding to a character to be printed simultaneously in all of said printing heads, and means for selectively completing an electrical circuit including one of said segments and the printing head positioned adjacent thereto such that said character is printed on said material.

3. A combination as claimed in claim 2 and wherein each of said printing heads includes an electrode matrix, the electrical condition corresponding to a character to be printed being simultaneously established in the electrode matrix of each of said printing heads.

4. In combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each positioned adjacent a different one of said segments, means for positioning a printable element between said row of segments and said printing heads, means for simultaneously establishing an electrical condition corresponding to a character to be printed in each of said printing heads, and means for selectively completing an electrical circuit including one of said segments and the printing head positioned adjacent thereto such that said character is electrostatically printed on said element.

5. In combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each positioned adjacent a different one of said segments, means for positioning a printable element between said row of segments and said printing heads, a source of signal energy in the form of a series of code characters, means connected to said source and responsive to the reception of a code character for simultaneously establishing an electrical condition corresponding to said received code character in each of said printing heads, and means for selectively completing an electrical circuit including one of said segments and the printing head positioned adjacent thereto such that said received code character is electrostatically printed on said element.

6. In combination, a plurality of conducting segments, a plurality of printing heads each positioned adjacent a different one of said segments and including an electrode matrix, means for positioning a sheet of paper between said segments and said printing heads, a source of signal energy in the form of a series of code characters, means connected to said source and responsive to the reception of a code character for simultaneously establishing an electrical condition corresponding to said received code character in the electrode matrix of each of said printing heads, and means for selectively completing an electrical circuit including one of said segments and the electrode matrix in the printing head positioned adjacent thereto such that the said received code character is electrostatically printed on said paper.

7. In combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each positioned adjacent a different one of said segments, means for positioning a sheet of paper between said row of segments and said printing heads, a source of signal energy in the form of a series of code characters, means connected to said source for simultaneously establishing in each of said printing heads an electrical condition corresponding to first one and then another of said code characters in the sequence in which said code characters are received, and means for sequentially completing an electrical circuit between said segments and said respective printing heads such that said code characters are electrostatically printed in a line on said paper.

8. A page printer comprising, in combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each including an electrode matrix and positioned adjacent a different one of said segments, means for positioning a sheet of paper between said row of segments and said printing heads, means for establishing an electrical condition corresponding to a character to be printed in the electrode matrix of each of said printing heads, and means for selectively completing an electrical circuit including one of said segments and the electrode matrix in the printing head positioned adjacent thereto such that said character is electrostatically printed on said paper.

9. A page printer comprising, in combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each including an electrode matrix and positioned adjacent a different one of said segments, means for positioning a sheet of paper between said row of segments and said printing heads, a source of signal energy in the form of a series of code characters, means connected to said source for simultaneously establishing in the electrode matrix in each of said printing heads an electrical condition corresponding to first one and then another of said code characters in the sequence in which said code characters are received, and means for sequentially completing an electrical circuit between said segments and the electrode matrices in said respective printing heads such that said code characters are electrostatically printed in a line on said paper.

10. A page printer comprising, in combination, a plu-

rality of conducting segments, a plurality of printing heads each positioned adjacent a different one of said segments, means for positioning a sheet of paper between said segments and said printing heads, a source of signal energy in the form of code characters each including a fixed number of serially appearing signal elements, a binary converter, a serial-to-parallel converter connected to said source over a single circuit and to said binary converter over separate circuits, said serial-to-parallel converter responsive to the reception of one of said code characters to change the condition of the signal elements therein into one in which the signal elements appear individually over said separate circuits, a character selector connected to said binary converter and to each of said printing heads, said binary converter responsive to the reception of the signal elements in said one code character to apply a predetermined control signal to said character selector, said character selector responsive to the reception of said control signal to simultaneously establish an electrical condition corresponding to said one code character in each of said printing heads, and switching means connected to said serial-to-parallel converter and to each of said segments responsive to the operation of said serial-to-parallel converter upon the complete reception thereby of said one code character for selectively completing an electrical circuit including one of said segments and said printing head positioned adjacent thereto, whereby said one code character is electrostatically printed on said paper.

11. A page printer comprising, in combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each positioned adjacent a different one of said segments, means for positioning a sheet of paper between said row of segments and said printing heads, a source of signal energy in the form of code characters each including a fixed number of serially appearing signal elements, a binary converter, a serial-to-parallel converter connected to said source over a single circuit and to said binary converter over separate circuits, said serial-to-parallel converter responsive to the reception of each of said code characters to change the condition of the signal elements therein into one in which the signal elements appear individually over said separate circuits, a character selector connected to said binary converter and to each of said printing heads, said binary converter responsive to the reception of the signal elements in each of said code characters to apply a predetermined control signal to said character selector, the particular control signal applied to said character selector in each instance being determined according to the code character received, said character selector responsive to the reception of each of said control signals to simultaneously establish an electrical condition corresponding to the received code character in each of said printing heads, and switching means connected to said serial-to-parallel converter and to each of said segments responsive to the operation of said serial-to-parallel converter upon the complete reception thereby of each of said code characters for sequentially completing an electrical circuit between said segments and said respective printing heads, whereby said code characters are electrostatically printed in a line on said paper.

12. A page printer comprising, in combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each including an electrode matrix and positioned adjacent a different one of said segments, means for positioning a sheet of paper between said row of segments and said printing heads, a source of signal energy in the form of telegraph code characters including a fixed number of serially appearing signal elements, a binary converter, a serial-to-parallel converter connected to said source over a single circuit and to said binary converter over separate circuits, said serial-to-parallel converter responsive to the reception of each of said code characters to change the condition of the signal elements therein into one in which the signal elements appear individually over said separate circuits, a character selector connected to said binary converter and to the electrode matrix in each of said printing heads, said binary converter responsive to the reception of the signal elements in each of said code characters to apply a predetermined control signal to said character selector, the particular control signal applied to said character selector in each instance being determined according to the code character received, said character selector responsive to the reception of each of said control signals to simultaneously establish an electrical condition corresponding to the received code character in the electrode matrix of each of said printing heads, and switching means connected to said serial-to-parallel converter and to each of said segments responsive to the operation of said serial-to-parallel converter upon the complete reception thereby of each of said code characters for sequentially completing an electrical circuit between said segments and the electrode matrices in said respective printing heads, whereby said code characters are electrostatically printed in a line on said paper.

13. A page printer as claimed in claim 12 and wherein additional means are connected between said positioning means and said binary converter, said binary converter responsive to the reception of the signal elements in the code character line feed to apply a second control signal to said additional means, said additional means responsive to each of said second control signals to cause said positioning means to move said paper line-by-line between said row of segments and said printing heads.

14. A page printer as claimed in claim 13 and wherein further means are connected between said binary converter and said switching means, said binary converter responsive to the reception of the signal elements in the code character carriage return to apply a third control signal to said further means, said further means responsive to each of said third control signals to cause said switching means upon the reception by said serial-to-parallel converter of the next code character to complete an electrical circuit including the one of said segments located opposite the left hand margin of said paper and the electrode matrix in the printing head positioned adjacent thereto, whereby said next code character is printed at the left hand side margin on said paper.

15. A page printer comprising, in combination, a plurality of conducting segments arranged in a row, a plurality of printing heads each positioned adjacent a different one of said segments and including an electrode matrix, means for positioning a printable element between said row of segments and said printing heads, means including a character selector responsive to the reception by said printer of the signal elements of a character to be printed to establish an electrical condition corresponding to said character simultaneously in the electrode matrix of each of said printing heads, and means including a stepping switch connected to said segments and responsive to the complete reception by said printer of the signal elements of said character to selectively complete an electrical circuit including one of said segments and the printing head positioned adjacent to said last-mentioned segment such that said character is printed on said element.

References Cited in the file of this patent

UNITED STATES PATENTS

2,334,543 Ballweg ---------- Nov. 16, 1943

OTHER REFERENCES

"Review of Input and Output Equipment Used in Computing Systems," Joint AIEE–IRE–ACM Computer Conference, pages 95–97 relied upon.