April 1, 1947. F. H. HANLEY 2,418,406

SELECTIVE SIGNALING SYSTEM

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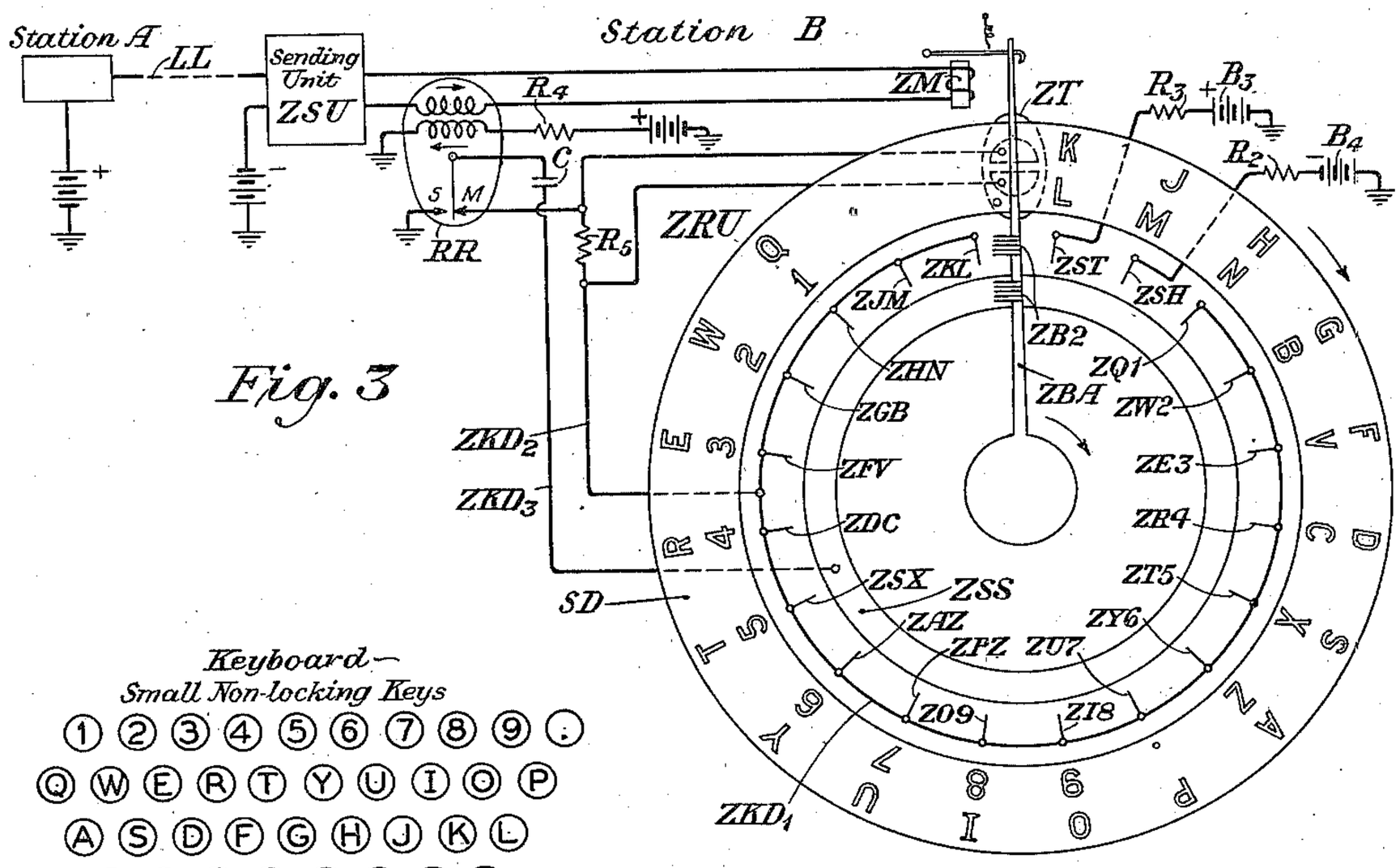

Fig. 3

Keyboard—
Small Non-locking Keys

1 2 3 4 5 6 7 8 9 .

Q W E R T Y U I O P

A S D F G H J K L

Z X C V B N M

Fig. 1

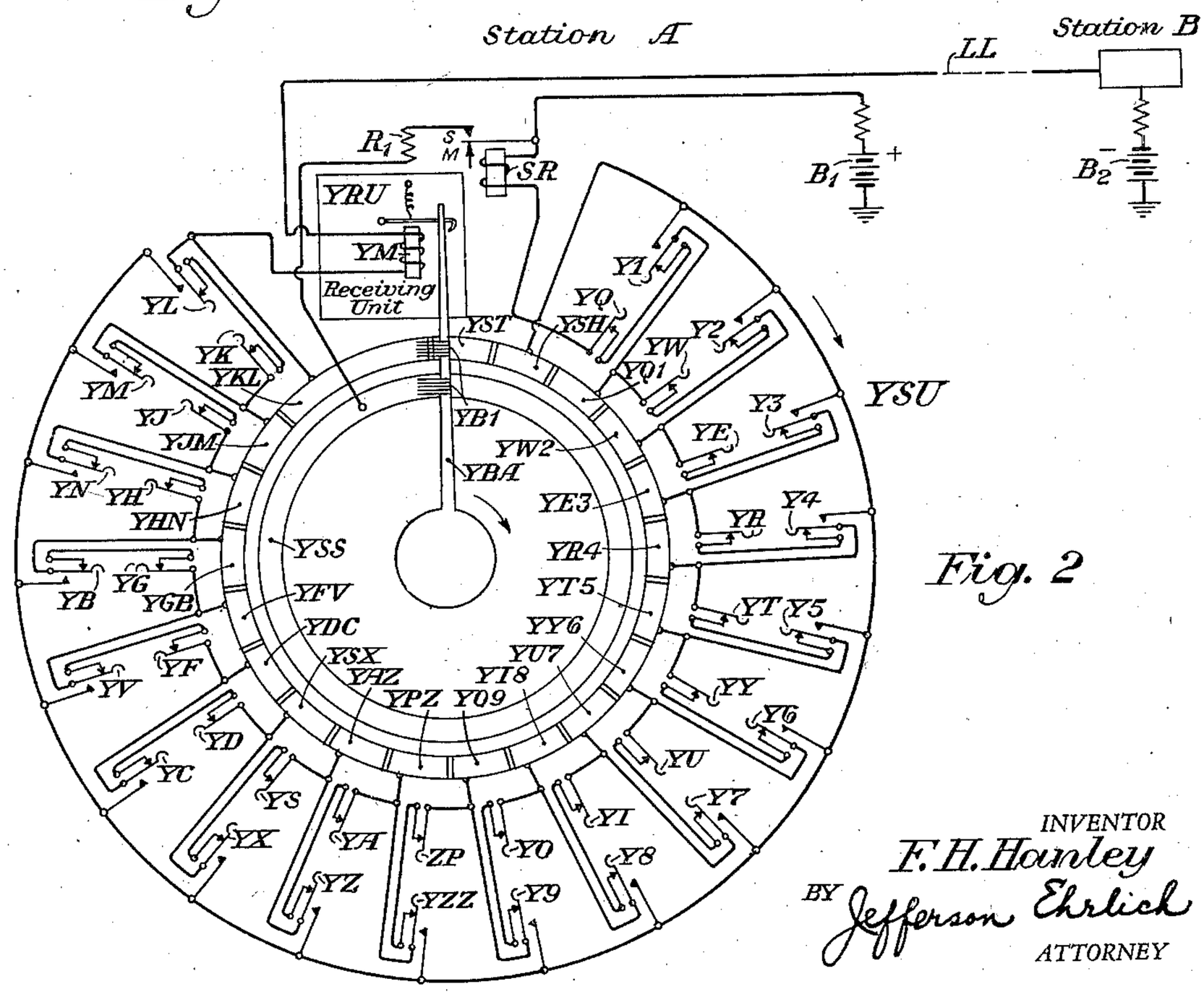

Fig. 2

INVENTOR
F. H. Hanley
BY Jefferson Ehrlich
ATTORNEY

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SELECTIVE SIGNALING SYSTEM

Frank Harold Hanley, Butler, N. J., assignor to American Telephone and Telegraph Company, a corporation of New York

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8 Claims. (Cl. 177—353)

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This invention relates to signaling systems and, more particularly, to apparatus for transmitting signals between two or more stations so that the signals may be rendered visible at the stations. Still more particularly, this invention relates to apparatus for transmitting groups of pulses from one station to one or more other stations in accordance with predetermined signals or characters, the apparatus including means at the receiving station or stations for converting the various groups of pulses corresponding to the signals or characters into visual signals or characters so that they may be observed and read at the receiving station or stations.

Divisional application Serial No. 545,864, dated July 20, 1944, directed to matter disclosed but not claimed in this application has been filed.

There are different types of equipment available for handling communications between telephone or telegraph offices. These include manual telegraph systems, teletypewriter systems and telephone systems. Manual telegraph systems usually contain simple parts and are therefore less costly than the other systems for simple routine communications. Hence such systems are used more frequently than the others. Teletypewriter systems embody more expensive apparatus, and it is often impractical to employ such apparatus at places where communication facilities are required. However, the use of manual telegraph systems for interoffice communication has fallen off recently because of the shortage of Morse operators, and because of the length of time required to train operators in the technique of sending and receiving Morse code signals.

Accordingly it is an object of this invention to provide simple and economical communication apparatus which will not require Morse operators or other skilled personnel. The arrangement of this invention in general consists of a transmitter having a start-stop distributor controlled by a plurality of non-locking push button keys arranged so that the operation of any key may produce two (or more) pulses, for example, a spacing pulse followed by a marking pulse, for transmitting a predetermined character or signal to a distant receiving point. The receiving apparatus involved in the invention may include a start-stop distributor, a scanning disk having transparent characters and a neon tube associated with the distributor and the scanning disk for furnishing illumination for the characters to be illuminated at the receiving station. The receiving apparatus is arranged to respond

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to the groups of pulses received and illuminate the character or signal defined by the pulses. The system differs from the usual teletypewriter system in that simpler codes are used to convey the signals or characters and, moreover, the signals or characters reproduced by the receiving apparatus are not recorded but are made visible for a brief interval of time. The receiving attendant will observe each character illuminated by the neon tube, and as the desired character appears before the scanning disk, it will be the only one illuminated at the receiving point.

In the apparatus used to carry out the invention about half of the characters may be transmitted by means of codes or signals having but two pulses which will be referred to as "two-transition codes." The first pulse of a two-transition code will be a spacing pulse, and it will be followed by a marking pulse. The overall length of the two pulses forming the code may be constant, but the relative lengths of the marking and spacing pulses will differ from each other for the different characters. The other half of the characters may be transmitted by means of codes having four pulses which will be referred to as "four-transition codes." The pulses forming the characters transmitted by four-transition codes include a spacing pulse, a marking pulse, a second spacing pulse and a second marking pulse. The first two pulses of the four-transition codes are short pulses of equal duration but the second spacing pulse generally will be of a different length from the second marking pulse. The relative lengths of the second spacing and marking pulses will be different from each other for the different characters transmitted by four-transition codes.

When considered from a different point of view, the transmitting apparatus may be thought of as producing different groups of pulses for the different characters to be transmitted. For the two-transition types of codes, the two pulses defining each character are of relatively different lengths, although the overall lengths of the pulses of the various groups are the same. The receiving apparatus includes a rotary device having the various characters displayed along its periphery at different peripheral distances from a fixed or predetermined point. Each character may be looked upon as dividing the circumference of the rotary device into two parts, which are proportional to the lengths of the two pulses defining that character. The reception of the first pulses will start the rotary device in rotation past the fixed or predetermined point and

at the same time cause a condenser to be charged. At the end of the first pulse, or at about the beginning of the second pulse, the condenser will be discharged at a rapid rate into a circuit including a gas tube of the neon type, causing the neon tube to be illuminated and to illuminate for a brief interval of time the desired character approximately at the time when that character passes the fixed or predetermined point. The attendant may then observe and read the transmitted character.

This invention will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawing in which Figure 1 represents a key-board such as may be found in the usual typewriter or teletypewriter, the keys of which are of a non-locking type, Fig. 2 shows a circuit arrangement of the invention in which the sending unit is illustrated in some detail, and Fig. 3 shows an arrangement similar to that of Fig. 2, except that the receiving unit is here shown in considerable detail.

The keyboard shown in Fig. 1 includes a plurality of non-locking keys such as may be found in the usual typewriter. These keys are employed to control the operation of the circuits of Figs. 2 and 3. Fig. 2 shows a station A at the left connected by a line LL to a station B at the right. These stations are also shown in Fig. 3 interconnected by the line LL. Each station may include both a sending unit and a receiving unit so that signals or characters may be transmitted in both directions between the stations. In Fig. 2 the sending unit is designated YSU and the receiving unit is designated YRU. In Fig. 3 the sending unit is designated ZSU and the receiving unit ZRU.

The various keys of the keyboard of Fig. 1 control corresponding contacts of the sending unit YSU. For example, the key Q of Fig. 1 may control the contact YQ of Fig. 2. When key Q is depressed, the contact YQ will be opened and held open as long as the key Q remains depressed. Likewise keys W, E, R, T, Y, etc. of Fig. 1 control the respective contacts YW, YE, YR, YT, YY, etc. of Fig. 2. The contacts YQ, YW, YE, etc. are shown for illustrative purposes positioned about the axis of the brush arm YBA forming the inner periphery of key-controlled contacts, while other contacts such as Y1, Y2, Y3, Y4, Y5, etc., which are also controlled by corresponding keys 1, 2, 3, 4, 5, etc. of the keyboard of Fig. 1, are likewise shown concentrically about the shaft of the brush arm YBA and form the outer periphery of key-controlled contacts.

The transmitting apparatus YSU (see Fig. 2) includes a distributor having a continuous inner segment YSS and a plurality of outer segments such as YST, YSH, YQ1, YW2 . . . YKL which are positioned adjacent to each other. A brush arm YBA controlled by magnet YM may be allowed to sweep over these segments of the distributor to produce groups of pulses corresponding to the various characters to be transmitted, as will be explained later. It will be observed that the contacts YQ, Y1, YW, Y2, YE, Y3 . . . YK, YL, are wired in series relationship with each other. This series circuit includes the winding of the relay SR and the magnet YM of the receiving unit YRU. This series circuit is connected by means of the line LL to the apparatus at the distant station B.

The receiving apparatus ZRU which is shown more fully in Fig. 3, includes, among other things,

a rotary device upon which is mounted a scanning disk SD affixed to a brush arm ZBA. The receiving unit also includes a condenser C and a neon tube ZT, which is positioned behind the scanning disk SD and will become illuminated by the discharge of condenser C in response to a signal or character received. The tube ZT will light up the desired signal or character received so that it may be observed and read by the attendant. The receiving unit ZRU also includes a distributor having a continuous inner segment ZSS and a plurality of small outer segments, such as ZST, ZSH, ZQ1, ZW2 . . . ZKL, which are arranged concentrically about the axis of the brush arm ZBA.

The brush arms YBA and ZBA at any one station, although shown and described hereinafter as separate and distinct elements, may, however, be the same element and this element may be controlled by the magnet such as YM of the station, as will be explained hereinafter. The brush arms YBA and ZBA are assumed to be connected to a suitable motor through a friction clutch (not shown) as will be understood by those skilled in the art.

When one of the keys, such as key Q, for example, of the keyboard of Fig. 1, is depressed, the contact YQ will be opened so as to interrupt the flow of current through the winding of relay SR and through the winding of magnet YM and over line LL to station B. This circuit will be held open as long as the key Q remains depressed. The absence of current over the line LL upon the depression of the key Q will cause the receiving relay RR at station B to move its armature to its spacing contact S and the magnet ZM at the same station will release. Considering for the moment the apparatus at the sending station A of Fig. 2, it will be observed that the release of the relay SR will connect the positive potential of battery B_1 to the continuous segment YSS over a circuit which includes the armature and back contact S of relay SR and resistor R_1. The simultaneous release of the magnet YM will unlatch the brush arm YBA and allow it to revolve in a clockwise direction. As the brush YB1 affixed to brush arm YBA passes over segments YST and YSH, the line LL will be kept open to prevent the flow of current to the apparatus at station B. As the brush YB1 contacts segment YQ1, however, the battery B_1 previously connected to the continuous segment YSS by the armature and contact of relay SR will be connected to the line LL and to the apparatus at station B. The circuit extending to line LL and to the apparatus at station B includes battery B_1, the armature and back contact S of relay SR, resistor R_1, the continuous segment YSS, brush YB1, segment YQ1, the contacts YW, Y2, YE, Y3, YR, Y4, YT, Y5 . . . YK, YL, the magnet YM of the receiving unit YRU and the line LL which extends to station B. The apparatus at station B terminates in a negative battery B_2 which is poled in series aiding relation to battery B_1. Thus, as the brush YB_1 contacts segment YQ1, a substantial potential will be applied to the line LL and current will flow over this line to the distant station B. As the brush YB1 passes over each additional segment YW2, YE3, YR4, YT5, YY6 . . . YKL, the voltage of battery B_1 will remain applied to line LL through the armature and back contact S of relay SR, thereby holding the line LL closed for the remainder of the revolution of the brush arm YBA.

It will be observed that in response to the de-

pression of the key Q of Fig. 1 the contact YQ is opened to interrupt the flow of current over line LL and that as the brush YBI contacts the segment YQ1, battery B_1 is connected to the line LL and remains connected to the line LL to allow a substantial flow of current thereover. The interruption of the flow of current over line LL produces a spacing pulse, and the subsequent closure of the line LL produces a marking pulse. The spacing pulse lasts for about two units of time, for example, while the corresponding marking pulse lasts for at least eighteen units of time. Thus the letter or character Q may be conveyed to the distant station B by means of a two-transition code, as already referred to. When the key W of Fig. 1 is depressed by the operator, the contact YW will be opened instead of the contact YQ, and hence a two-transition code consisting of a spacing pulse of about three units and a corresponding marking pulse of at least seventeen units will be transmitted over the line LL to the apparatus at station B. The character E may likewise be conveyed to the distant station B by a spacing pulse of four units and a corresponding marking pulse of at least sixteen units, and so on. Each of these characters is defined by two pulses which are relatively different from each other, but the overall lengths of the various pairs of pulses are the same.

It is observed that the magnet YM of Fig. 2 is connected in series with the line LL so that the current that flows over the line LL also traverses the winding of the magnet YM. Hence as soon as the battery B_1 is connected to the line LL the magnet YM will become re-energized. The re-energization of the magnet YM will cause its latch to drop into its normal position to prevent the further rotation of the brush arm YBA after it has completed one revolution. It is also noted that the relay SR will be released only as long as one of the keys of the keyboard remains depressed. As soon as the key is released, the winding of relay SR will become re-energized so as to cause its armature to close its contact M. The operation of relay SR will remove the resistor R_1 from the circuit so that the sending apparatus will be ready for the transmission of another character.

The relay SR is adjusted so as to be slightly slower to release than magnet YM, the release of the relay being completed before brush YB1 leaves segment YST. Consequently, upon the depression of one of the keys of the keyboard, such as key A, the series circuit including the windings of relay SR and magnet YM will be opened, allowing the brush arm YBA to start to rotate just before the armature of relay SR releases to close its back contact S. Upon the closure of contact S by the armature of slow-release relay SR, battery B_1 will be connected through resistor R_1 to the continuous segment YSS. Hence, when brush YB1 reaches the segment YAZ, current will again traverse the winding of magnet YM, as already explained. This circuit may be traced from battery B_1, the armature and contact S of relay SR, resistor R_1, continuous segment YSS, brushes YB1 of brush arm YBA, segment YAZ, contacts YS, YX, YD, YC . . . YK, YL, magnet YM, and line LL to station B and battery B_2. This circuit will cause magnet YM to become re-energized to attract its latch so as to prevent the brush arm YBA from rotating more than one revolution even if the attendant holds the key A depressed longer than is required for the brush arm YBA to complete its revolution. Relay SR will become reoperated after the previously depressed key A has been released. After relay SR operates in response to the release of the previously depressed key, the pulses corresponding to the same character or any other character may be transmitted by depressing the appropriate key of the keyboard.

Any one of contacts YQ, YW, YE, YR, YT . . . YK, which are shown on the inner periphery of the sending unit YSU may be opened by the corresponding key of the keyboard of Fig. 1 for sending a two-transition code over line LL to the receiving station B. The remaining contacts Y1, Y2, Y3, Y4, Y5 . . . YL shown on the outer periphery of the sending unit YSU are controlled by other keys of the keyboard of Fig. 1. When the key 1 of Fig. 1 is depressed, the swinger of the contact Y1 will be moved upwardly to close the upper contact (which is normally open) for transmitting coded impulses over the line LL. As the contact Y1 becomes so operated, it will open the circuit of the line LL extending to station B, this circuit having been previously described with respect to the transmission of the character Q to the distant station B. As the magnet YM becomes released, the brush arm YBA will again rotate in a clockwise direction in the same manner as already described heretofore. As the brush YB1 passes over segment YST, the line LL will be opened in the same manner as the line LL was initially opened when the key Q was operated.

When the brush YB1 contacts segment YSH, battery B_1 will be connected to line LL and station B over a circuit which includes, in addition to battery B_1, the armature and back contact S of relay SR, resistor R_1, the continuous segment YSS, brush YB1, segment YSH, the contacts of Y1, contacts YW, Y2, YE, Y3, YR, Y4 . . . YK, YL, magnet YM, line LL and station B. This will close line LL and the line will remain closed during the remainder of the travel of brush arm YBA throughout its revolution. Thus the operation of key 1 will produce a spacing pulse followed by a marking pulse, these pulses resembling the pulses produced by operating key Q, but it will be shown hereinafter that the character 1 will be exhibited at the receiving station B.

When key 2 of Fig. 1 is closed, the swinger of contact Y2 will be moved upwardly to close its upper terminal (which is normally open). This will cause relay SR and magnet YM to release, as already described. The release of magnet YM will again permit the brush arm YBA to rotate as before. As brush YB1 contacts segment YST, the line LL will be opened by the disconnection of battery B_1 from line LL. This will result in a spacing pulse. Battery B_1 will be connected to line LL when brush YB1 contacts segment YSH, the circuit to line LL being completed through segment YSH, contact Y2, contacts YE, Y3, YR, Y4 . . . YK, YL and the winding of magnet YM. This will result in a marking pulse. When brush YB1 contacts segment YQ1, the battery B_1 will again be disconnected from line LL at the contacts Y2 and hence there will be another spacing pulse. When brush YB1 then contacts segments YW2, the battery B_1 will again be connected to line LL, the circuit being completed through segment YW2, contacts YE, Y3, YR, Y4, YT, Y5 . . . YK, YL, magnet YM, and line LL. This will produce a second marking pulse. The circuit to line LL will remain closed during the remainder of the travel of brush YB1 through its cycle. Thus the operation of key 2 will result in four pulses, i. e., spacing, marking, spacing

and marking pulses, the first three of the pulses being substantially equal unit pulses while the fourth pulse will be a relatively long pulse of about seventeen units. Similarly when key 3 of Fig. 1 is depressed, the first two pulses will be substantially equal unit pulses, the third (spacing) pulse will be about two units long and the fourth (marking) pulse will be about sixteen units long. Other keys associated with the contacts of the outer periphery will cause the production of two unit pulses (spacing and marking pulses) followed by two longer pulses of relatively different lengths.

At station B (Fig. 3) the various groups of pulses received operate the relay RR and cause its armature to follow these pulses. The armature of the relay RR will close its contact S when a spacing pulse is received and its contact M when a marking pulse is received. The segments ZQ1, ZW2, ZE3, ZR4, ZT5, ZY6 . . . ZKL, although positioned concentrically about the axis of the brush arm ZBA and separated from each other, are nevertheless conductively connected to each other by a conductor ZKD_1. As the first or spacing pulse corresponding to the letter Q is received and the armature of relay RR closes its contact S, the absence of current in the magnet ZM (due to the opening of the circuit of the line LL) will unlatch the brush arm ZBA to enable it to rotate in a clockwise direction. As the brush ZB2 contacts segment ZST—which is a short segment and is contacted at about the time when the brush YBA at the transmitter is half way across segment YST—the condenser C will become charged to the positive voltage of battery B_3. The charging circuit for condenser C includes battery B_3, resistor R_3, segment ZST, brush ZB2, the continuous segment ZSS, and conductor ZKD_3 which is connected to the lower terminal of condenser C, the upper terminal of the condenser C being connected to ground through the armature and contact S of relay RR. The battery B_3 will be disconnected from the condenser C immediately after the brush ZB2 leaves the segment ZST, but the positive potential applied to the condenser C will remain substantially unchanged. As the brush ZB2 next contacts the segment ZSH—which is positioned so that its contact with the brush ZB2 will occur at about the time when the brush YB1 at station A is half-way across the segment YSH—the negative battery B_4 will then be connected to the condenser C. The circuit to condenser C now includes battery B_4, resistor R_2, segment ZSH, brush ZB2, continuous segment ZSS, and conductor ZKD_3 connected to the lower terminal of condenser C, the upper terminal of which is still connected to ground through the armature and contact S of relay RR. As the latter circuit interconnecting battery B_4 to condenser C is completed, the condenser C will first discharge and then charge to the opposite or negative potential of battery B_4. When the brush arm YBA at the transmitter reaches the segment YQ1, current will again flow over the line LL and through the upper winding of relay RR as already described hereinabove, thereby causing the armature of relay RR to close its contact M. At the same time the magnet ZM will be re-energized so as to lower its latch to its normal position to prevent any further movement of the brush arm ZBA after it has completed a revolution. But it is noted that the brush YB1 at the transmitter of Fig. 2 is midway through its segment YQ1 at the time when brush ZB2 of Fig. 3 contacts segment ZQ1. At that time conductor ZKD_1 will be effectively connected to the conductor ZKD_3 through the continuous segment ZSS. Consequently the resistor R_5 will be bridged across the condenser C, the bridging circuit including the armature and contact M of relay RR, the resistor R_5, conductors ZKD_2 and ZKD_1, brush ZB2, continuous segment ZSS and conductor ZKD_3.

It is noted also that the two electrodes of the neon tube ZT are bridged across the resistor R_5. Thus both the tube ZT and the resistor R_5 are shunted across the condenser C at about the time when the brush ZB2 contacts the segment ZQ1. The condenser C is, therefore, discharged at a very rapid rate. In discharging the upper or positive terminal of the condenser will be connected to the upper terminal or electrode of the tube ZT, while the lower or negative terminal of the condenser C will be connected to the lower terminal or electrode of the tube ZT. The application of a voltage of such polarity to the electrodes of the tube ZT will cause the upper electrode of the tube ZT to become luminous, and the luminosity will remain substantially the same until the voltage on the condenser C is reduced below the voltage required to sustain ionization within the tube ZT. The time during which the upper electrode of tube ZT remains luminous depends on the constants of the discharge circuit and tube ZT.

It will be remembered that the scanning disk SD is fixed to the brush arm ZBA so that both rotate together about their common axis. It follows, therefore, that when the brush arm ZBA contacts the segment ZQ1, the letter Q of the scanning disk SD will then be positioned immediately in front of the upper electrode of the tube ZT which has just become luminous. Therefore, the letter Q will become visible to the attendant. The letter Q may be, for example, transparent so that the light emanating from the upper electrode of tube ZT will freely traverse the transparent contour of the letter. The letter Q will, therefore, be visible for a brief but appreciable period of time, an interval long enough to enable the attendant to observe it. Were the key W of Fig. 1 depressed instead of the key Q, the condenser C at the receiver would discharge at about the time when the brush ZB2 contacted the segment ZW2. In this case, of course, the letter W of the scanning disk SD would be positioned adjacent to the upper electrode of the tube ZT at the time when the upper electrode of tube ZT became luminous and then letter W would be visible to the attendant. And so on for each of the other two transition codes transmitted from station A of Fig. 2 to station B of Fig. 3 to convey other characters such as E, R, T, etc. to the distant station B.

When the pulses corresponding to the character No. 1 are received at station B, the first spacing pulse (of unit length) will release the magnet ZM of Fig. 3, thereby permitting the brush arm ZBA to rotate clockwise. When the brush ZB2 contacts segment ZST, the positive potential of battery B_3 will be applied to the lower terminal of condenser C over the same circuit previously described with regard to the response to the first spacing pulse of the character Q. Upon the reception of the subsequent marking pulse from station A, relay RR will cause its armature to close its contact M. When brush ZB2 contacts segment ZSH, the negative potential of battery B_4 will be connected to the lower terminal of condenser C, but condenser C will not be dis-

charged at that time. The reason for the positive charge remaining on condenser C is that the upper terminal of the condenser is not connected to ground through the armature and contact S of relay RR and hence there is no complete discharge path for the condenser.

When the brush ZB2 thereafter contacts segment ZQ1, the condenser C will then be discharged over a circuit which includes the lower plate of condenser C, conductor ZKD_3, segment ZSS, brush ZB2, segment ZQ1, conductor ZKD_1, conductor ZKD_2, resistor R_5, the armature and contact M of relay RR, and the upper plate of condenser C. It is observed that the terminals of tube ZT are connected to resistor R_5 and therefore the voltage across condenser C is also applied to the plates of tube ZT. In this instance, however, the lower plate of tube ZT will receive the positive potential previously applied to the lower plate of condenser C, thereby causing the lower plate of tube ZT to become illuminated. The character 1 of the scanning disk SD will be positioned in front of the lower plate of tube ZT just when it is illuminated so that the character 1 will become visible to the attendant.

When the pulses corresponding to the character 2 are received from station A, the first unit spacing pulse moves the armature of relay RR to its contact S. As brush ZB2 contacts segment ZST, the condenser C becomes charged by battery B_3 to render the lower plate of condenser C positive with respect to its upper plate, as already explained hereinabove. The first unit marking pulse received from station A will then move the armature of relay RR to its marking contact M. Hence when brush ZB2 contacts segment ZSH, the positive charge on the lower plate of condenser C will remain undisturbed, as explained hereinabove in regard to the reception of the marking pulse of character No. 1 at the time when brush ZB2 contacts segment ZSH. When the second unit spacing pulse is received, the armature of relay RR will return to its spacing contact S and hence when brush ZB2 contacts segment ZQ1, the charge on condenser C will remain substantially unaffected. This is because the connection of conductors ZKD_1, ZKD_2 and ZKD_3 to each other by brush ZB2 and segments ZQ1 and ZSS will not discharge the condenser C when the armature of relay RR is removed from its contact M. However, when the second marking pulse is received it will move the armature of relay RR to its contact M. Hence when brush ZB2 contacts segment ZW2, the discharge path for condenser C will be completed. Condenser C will then discharge through resistor R_5 and tube ZT and will illuminate the lower plate of tube ZT because it has then been rendered sufficiently positive with respect to its upper plate. The illumination of the lower plate of tube ZT will occur at about the time when character 2 of the scanning disk SD is opposite the illuminated plate. This character will therefore become visible to the attendant. The illumination of tube ZT will cease immediately after the condenser's voltage is discharged below the ionization point of the tube even though the character 2 has not passed tube ZT.

Similarly the reception of pulses corresponding to other characters such as 3, 4, etc., will illuminate the tube ZT at about the time when the second marking pulse is received. Thus in all cases of two-transition characters, the second marking pulse will initiate the discharge of condenser C for a brief, but appreciable time interval and illuminate the lower plate of tube ZT at about

the time when the particular character of the scanning disk SD reaches the tube ZT. The tube ZT is stationary. Its position marks a point which is spaced from the various characters of disk SD by peripheral distances which correspond to the interval preceding the final marking pulse received.

If desired all of the characters on disk SD may be spaced from each other at shorter intervals so that they may all be conveyed from station A to station B either by two-transition pulses or by four-transition pulses. If only one type of pulse is used, the apparatus will be somewhat simpler and more easily constructed.

It is important to hold any one of the keys of Fig. 1, such as key E, depressed until the brush arm passes the segment YE3 which is connected to contact YE controlled by key E. This will prevent errors in signaling. If this precaution is observed, the apparatus will operate satisfactorily.

Instead of a device for the transient illumination of the received character, the receiver may include a printing relay or magnet for printing the characters on a tape. The winding of the printing relay or magnet would then be energized by the condenser discharge current. This relay or magnet might serve to press the tape against the disk SD to print the character adjacent to the relay or magnet. The tape may be controlled for step-by-step action by a relay having its winding in series with the resistance R_3.

Instead of a device for the transient illumination of the received characters, the receiver may include a unit for recording the received characters on a film or tape. In this case the disk with transparent characters would be rotated between the neon tube and a photographic film or paper, (not shown) all enclosed in a dark chamber. The film or tape may be controlled for step-by-step action by a relay having its winding in series with the resistance R_3. The light emanating from the neon tube with this arrangement would traverse the transparent contour of any character of the disk SD and cause a portion of the film or paper corresponding to the contour of the received character to be exposed to the light of the tube, thus providing a photographic record of the received characters.

Although the invention has been described as enabling an operator to signal from station A to station B, the arrangement is suitable for two-way signaling between stations A and B (and any other stations).

While this invention has been shown and described in certain particular embodiments merely for illustrative purposes, the invention is equally applicable to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A signaling system comprising means for producing pairs of pulses the relative time lengths of which differ from each other in accordance with the characters to be transmitted, although the overall time length of each pair of pulses remains the same, a rotary device bearing the various characters along its periphery at different peripheral distances from a predetermined point, a condenser, a gas tube, means responsive to the first of the pulses of each pair to start said rotary device and to charge said condenser, and means responsive to the second of the pulses of each pair to discharge said condenser through said tube to illuminate the character upon the peri-

phery of said device as it passes a predetermined point.

2. Receiving apparatus for reproducing characters transmitted by pairs of pulses of relatively different time lengths, although the overall time lengths of the different pairs of pulses are the same, comprising a rotary disk having the different characters exhibited along its periphery, each character appearing at different peripheral distances from a predetermined point about said disk, a condenser, a light-producing device, means responsive to the first pulse of each pair received to rotate said disk and to charge said condenser, and means responsive to the second received pulse of each pair to discharge said condenser through said light-producing device to illuminate said predetermined point so as to exhibit the character defined by the received pulses.

3. The combination of means for producing pairs of pulses, each pair of pulses defining a different character, the relative lengths of time of said pulses differing from each other although the overall lengths of time of the various pairs of pulses are the same and are equal to a predetermined time interval, a rotary device bearing the different characters along its periphery at different periphreral distances from a predetermined point, said rotary device including a plurality of segments each corresponding to a different character, said segments being positioned concentrically about the axis of said rotary device, a condenser, means responsive to the first of the pulses of each pair to start said rotary device and to charge said condenser, an illuminating element, means responsive to the second of the pulses of each pair to discharge said condenser through one of said segments to operate said illuminating element thereby to illuminate the periphery of said rotary device as it passes said predetermined point, whereupon the character corresponding to the received pulses will be exhibited.

4. Receiving apparatus for responding to pulses of different lengths of time, each pulse corresponding to a different character, comprising a rotary device upon the periphery of which are exhibited the characters to be conveyed by said pulses, said rotary device including a plurality of segments which are positioned concentrically about the axis of said rotary device, each segment corresponding to but one of said characters, a condenser, means responsive to the receipt of each of said pulses to start said rotary device in rotation from a predetermined point and to charge said condenser, an illuminating device, means responsive to the termination of each of said pulses to discharge said condenser so as to produce a surge of current through one of said segments to operate the said illuminating device as it passes said predetermined point and illuminate the character appearing at the periphery of said rotary device as the latter passes said predetermined point.

5. The combination of means for producing pairs of pulses in accordance with different characters to be transmitted, the relative time lengths of the pulses of each pair differing from each other although the overall time length of the two pulses of each pair remains the same, a condenser, a gas tube, a rotary device upon which are exhibited the different characters at different peripheral distances from a predetermined point, said rotary device having a plurality of segments positioned concentrically about the axis of said rotary device, each segment corresponding to a

different character, means responsive to the first of the pulses of each pair to start said rotary device and to charge said condenser, means initiated by the second of the pulses of each pair to discharge said condenser so as to produce a surge of current through one of said segments to ionize the gas of said tube and illuminate the character corresponding to the received pulses.

6. Receiving apparatus for reproducing characters transmitted by pairs of pulses of relatively different time lengths although the overall time lengths of all of said pairs of pulses are the same, comprising a rotary disk having the different characters exhibited along its periphery, each character occurring at different predetermined peripheral distances from a predetermined point about said disk, said disk having a plurality of segments at corresponding peripheral distances from another predetermined point on said disk, a condenser, means responsive to the first pulse of each pair received to rotate said disk and to charge said condenser, an illuminating element, and means responsive to the initiation of the second received pulse of each pair to discharge said condenser through one of said segments to operate said illuminating element and thereby illuminate the character defined by said received pulses.

7. The combination of means for producing pairs of pulses in accordance with characters to be transmitted, the two pulses of each group being of relatively different time lengths although the overall time length of both pulses of each pair is the same, receiving apparatus for reproducing said characters in accordance with the received groups of pulses, said receiving apparatus including a rotary device having the different characters arranged concentrically about its axis at different peripheral distances from a predetermined point, said rotary device having a plurality of segments also arranged concentrically about the axis of said rotary device, one segment corresponding to each different character, a condenser, a light-producing device, means controlled by the received pulses for charging said condenser and then discharging said condenser through one of said segments to illuminate said light-producing device, thereby illuminating the character corresponding to the received pulses as said rotary device reaches said predetermined point in its rotation.

8. The combination of means for producing groups of two pulses of relatively different time lengths corresponding to characters to be transmitted, the overall additive time lengths of the different groups of pulses being the same, a rotary device having said characters positioned along its periphery so that each character appears at a point which divides the circumference of said rotary device into two parts corresponding to the relative lengths of the two pulses of each group, said rotary device including a plurality of segments positioned concentrically about the axis of said rotary device, each segment corresponding to one of the characters, a condenser, means responsive to the first pulse of each received group of pulses to rotate said rotary device through one revolution and to charge said condenser, a light-producing element, and means initiated by the second pulse of each group to discharge said condenser through one of the segments of said rotary device to illuminate said light-producing element, the illumination being directed at a point in the path of the rotary device at which appears

the character corresponding to the received group of pulses.

FRANK HAROLD HANLEY.

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