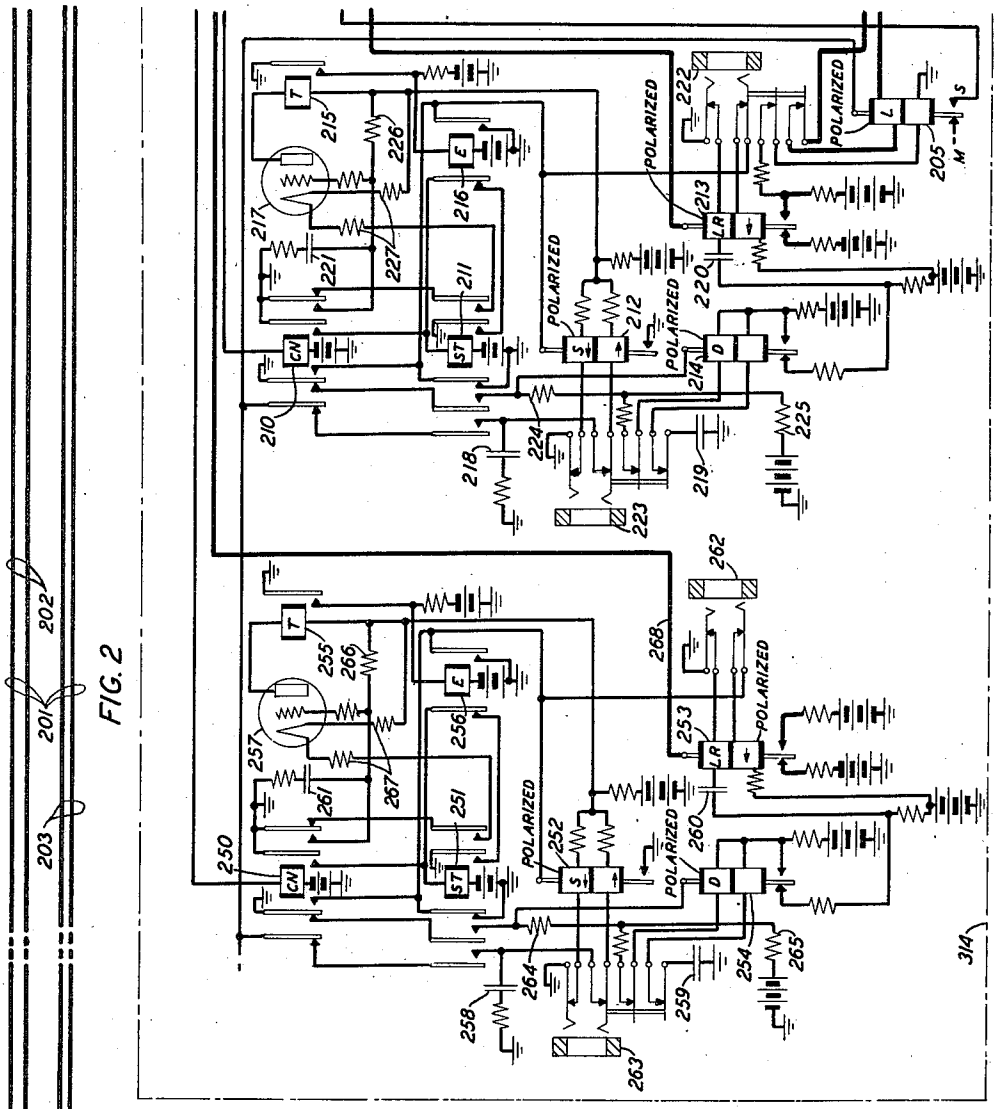
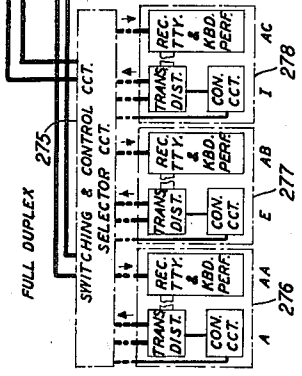
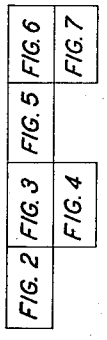
April 24, 1945. W. M. BACON ET AL 2,374,264

COMMUNICATION SYSTEM

Filed Aug. 26, 1942 6 Sheets-Sheet 1







INVENTORS W.M.BACON
F.S.KINKEAD, DECEASED
RITA S. KINKEAD
HIS ADMINISTRATRIX
BY William F. Simpson.
ATTORNEY

April 24, 1945. W. M. BACON ET AL 2,374,264

COMMUNICATION SYSTEM

Filed Aug. 26, 1942 6 Sheets-Sheet 2

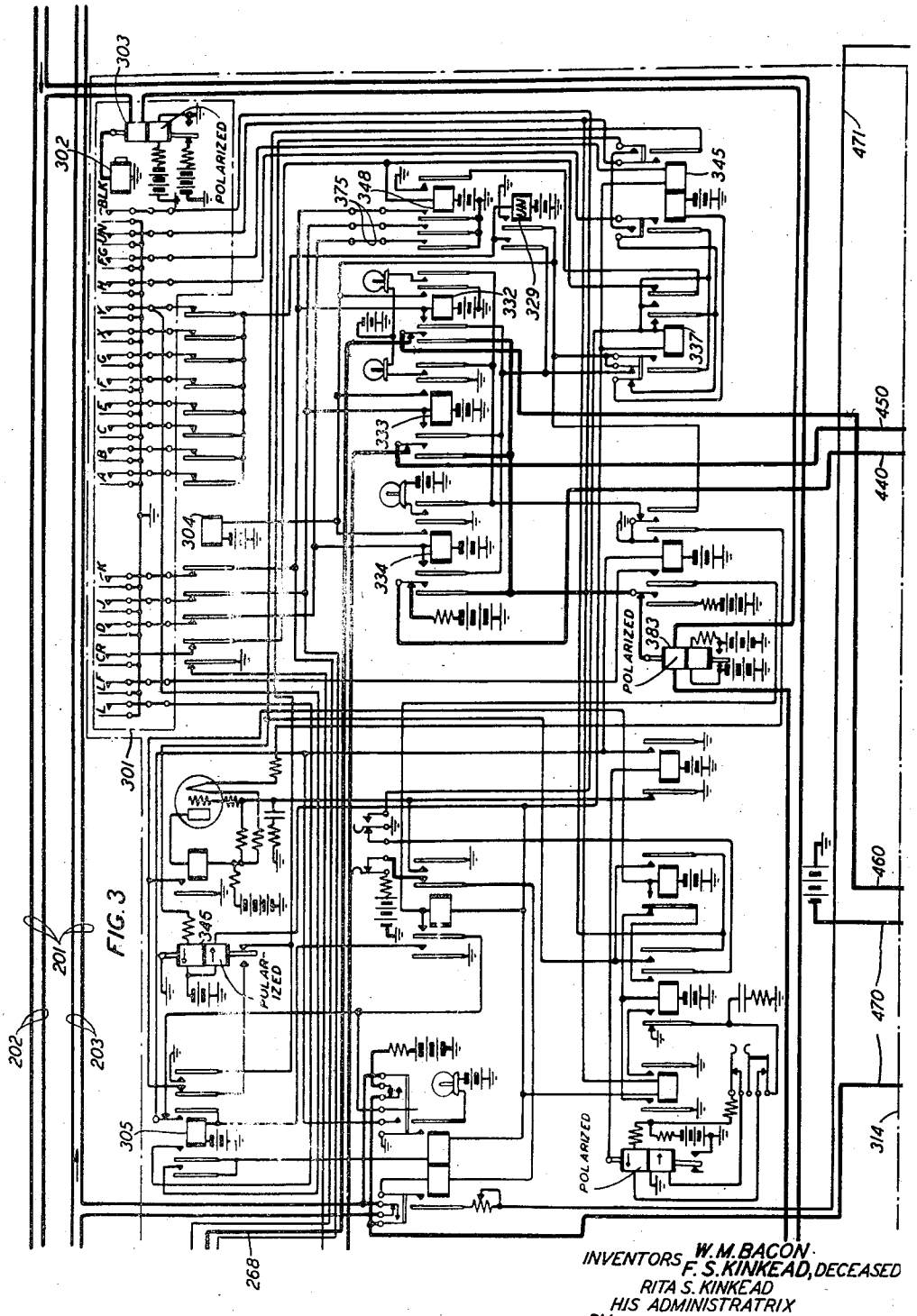


FIG. 3

INVENTORS W. M. BACON
F. S. KINKEAD, DECEASED
RITA S. KINKEAD
HIS ADMINISTRATRIX
BY William F. Simpson.
ATTORNEY

April 24, 1945. W. M. BACON ET AL 2,374,264

COMMUNICATION SYSTEM

Filed Aug. 26, 1942 6 Sheets-Sheet 3

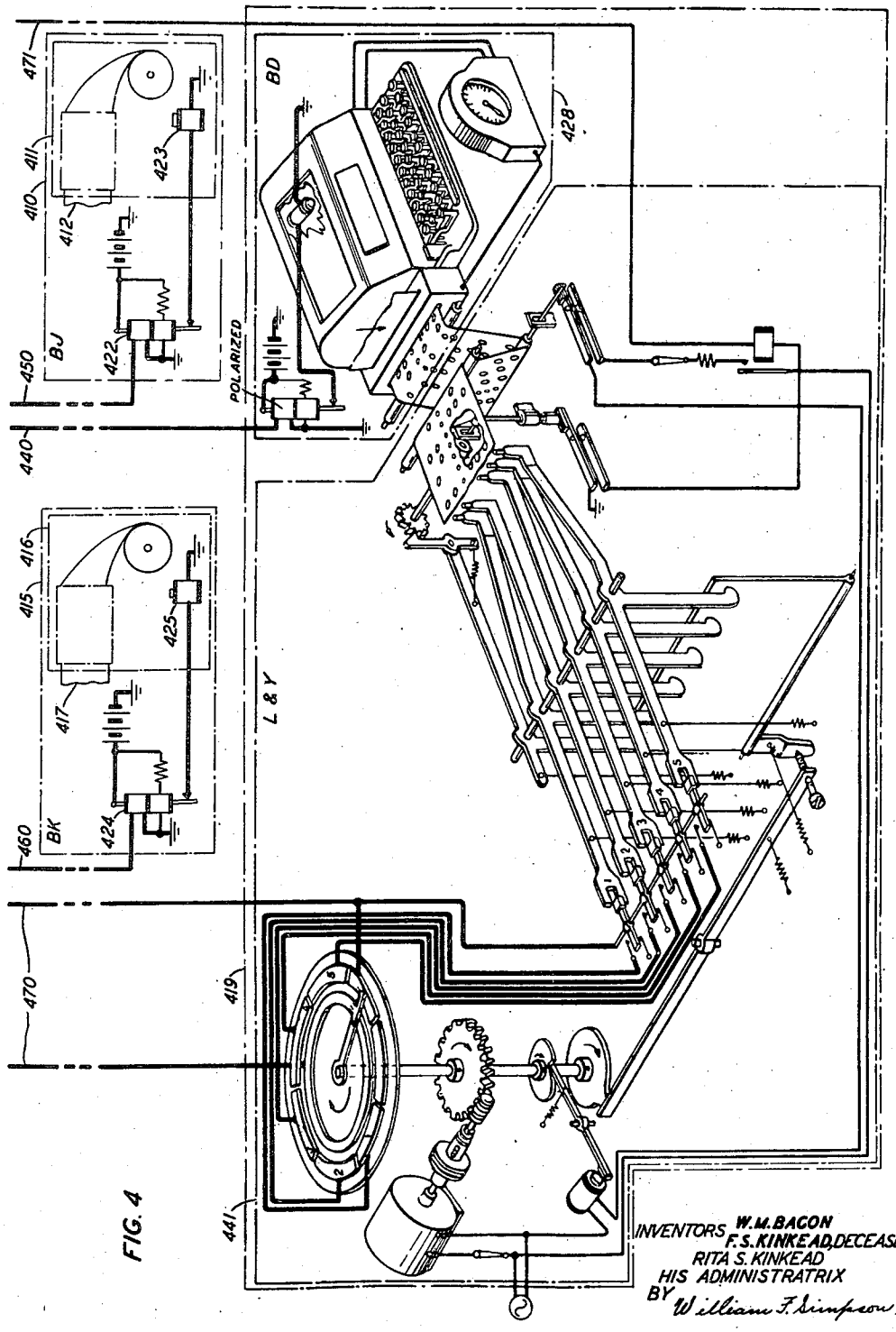


FIG. 4

INVENTORS W.M.BACON
F.S.KINKEAD, DECEASED
RITA S. KINKEAD
HIS ADMINISTRATRIX
BY William F. Simpson
ATTORNEY

April 24, 1945. W. M. BACON ET AL 2,374,264

COMMUNICATION SYSTEM

Filed Aug. 26, 1942 6 Sheets-Sheet 4

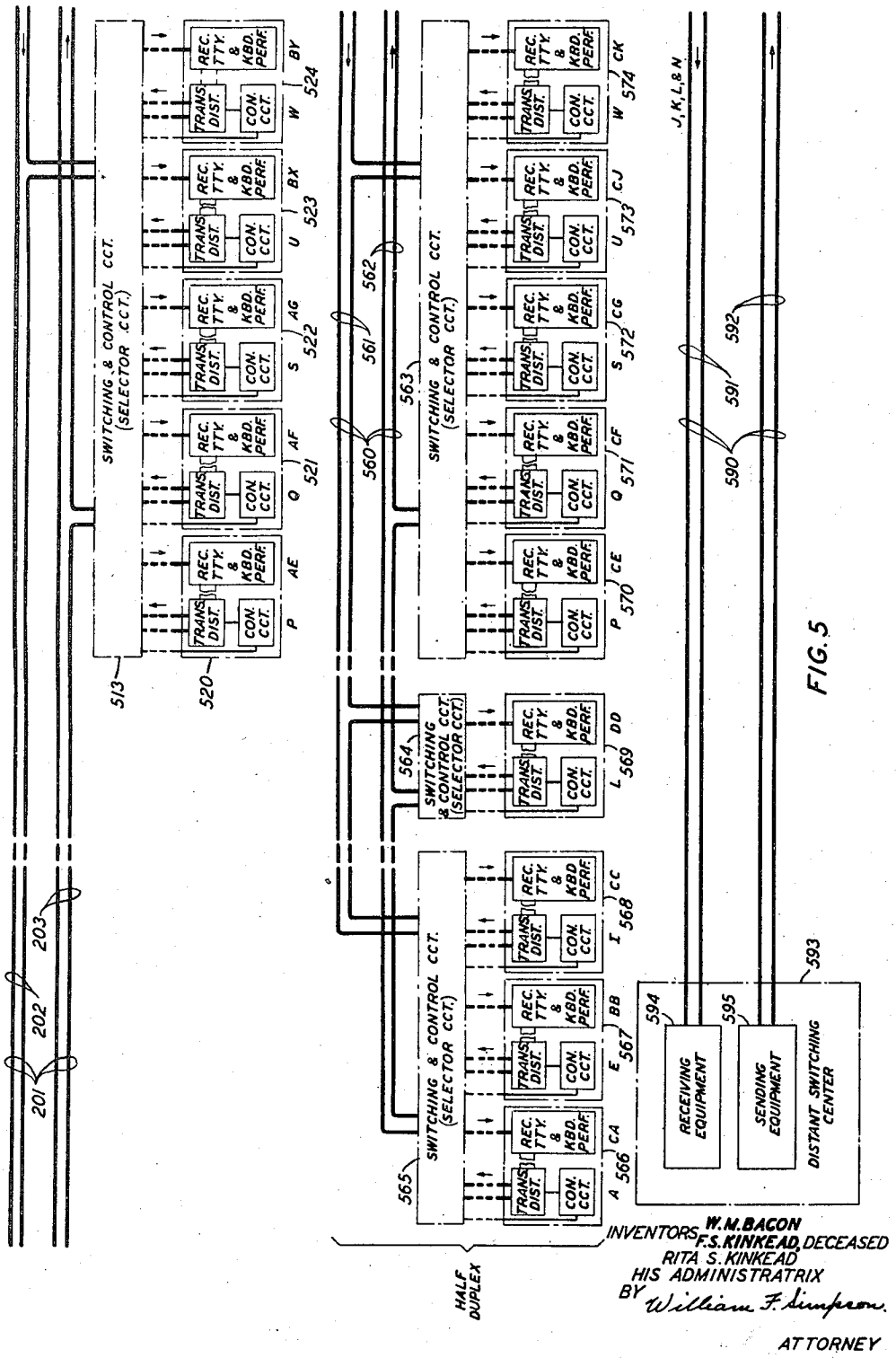


FIG. 5

INVENTORS W. M. BACON
F. S. KINKEAD, DECEASED
RITA S. KINKEAD
HIS ADMINISTRATRIX
BY William F. Simpson
ATTORNEY

April 24, 1945. W. M. BACON ET AL 2,374,264

COMMUNICATION SYSTEM

Filed Aug. 26, 1942 6 Sheets-Sheet 5

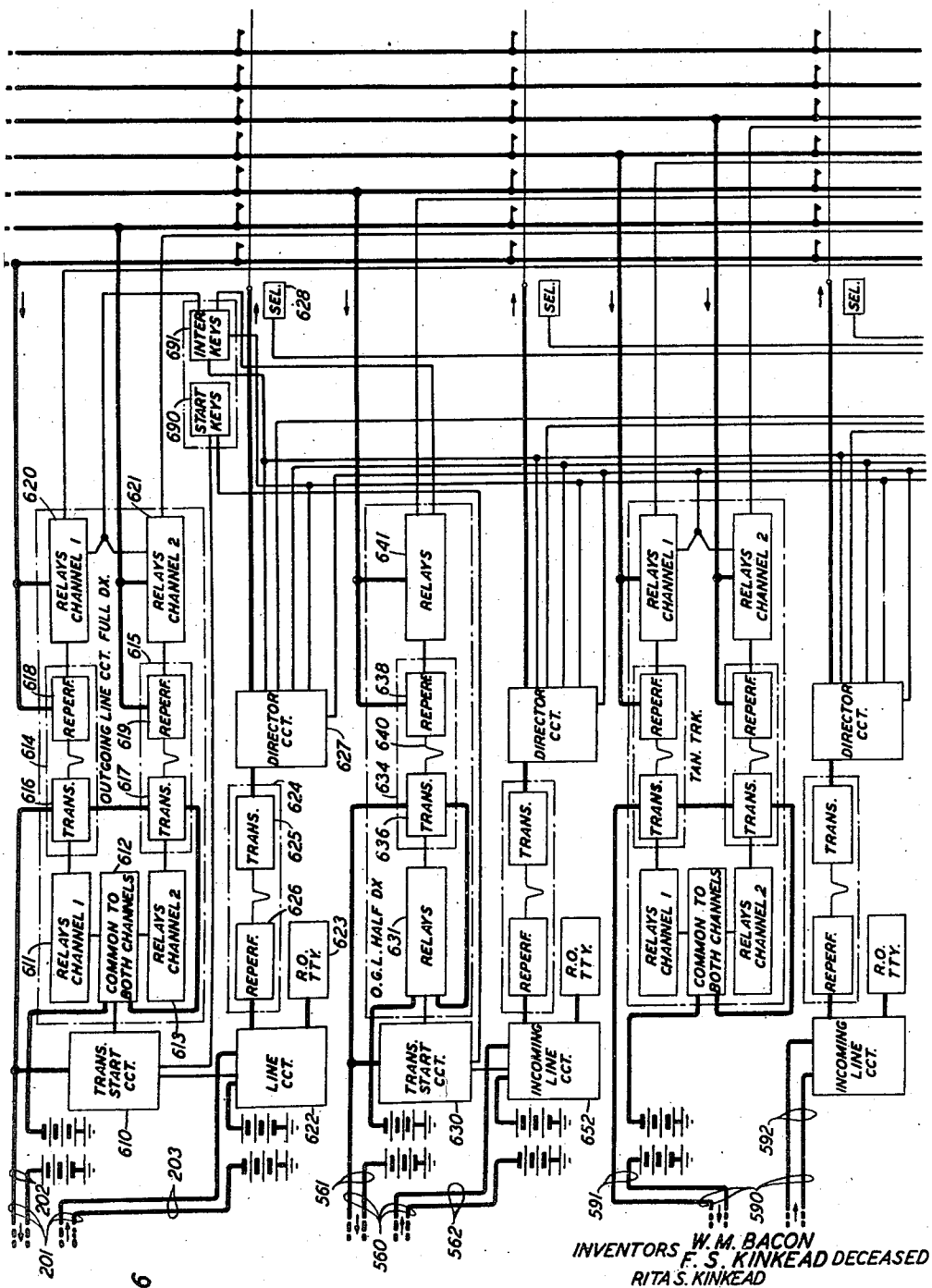


FIG. 6

INVENTORS W. M. BACON
F. S. KINKEAD DECEASED
RITA S. KINKEAD
HIS ADMINISTRATRIX
BY William F. Simpson.
ATTORNEY

April 24, 1945. W. M. BACON ET AL 2,374,264

COMMUNICATION SYSTEM

Filed Aug. 26, 1942 6 Sheets-Sheet 6

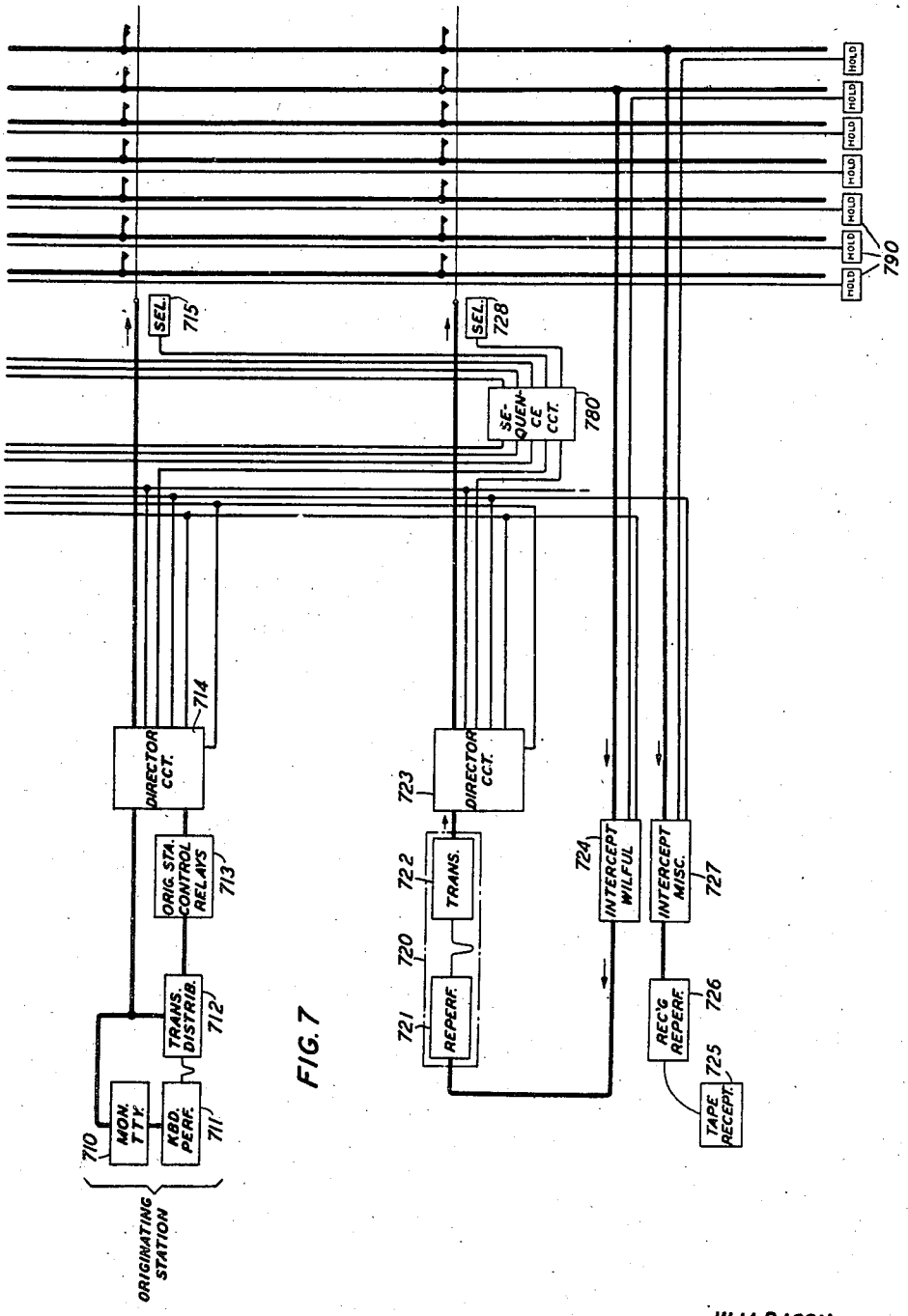


FIG. 7

INVENTORS W. M. BACON
F. S. KINKEAD, DECEASED
RITA S. KINKEAD
HIS ADMINISTRATRIX
BY William F. Simpson
ATTORNEY

Patented Apr. 24, 1945 2,374,264

UNITED STATES PATENT OFFICE

2,374,264

COMMUNICATION SYSTEM

Walter M. Bacon, New York, N. Y., and Fullerton S. Kinkead, deceased, late of New York, N. Y., by Rita Smith Kinkead, administratrix, New York, N. Y., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application August 26, 1942, Serial No. 456,146

13 Claims. (Cl. 178—3)

This invention relates to communication systems and more particularly to telegraph systems in which received telegraph signals are recorded by a receiving instrument.

It is frequently desirable in systems wherein telegraph signals or messages are recorded by telegraph receiving instruments to cause the medium upon which the signals are recorded to be automatically advanced out of the recording instrument at the end of the message or at the end of a group of signals characterized by any distinguishing characteristics.

In case it is desired to receive telegraph signals upon reperforating instruments or a printing reperforator, it is particularly desirable to cause the machine to advance the recording medium or tape after the last message character is recorded upon the instrument so that the entire message will extend beyond the machine thus permitting the message to be removed from the machine and taken to any retransmitting point or instrument or any other suitable place for editing, storage or other desirable purpose.

However, in case another message is directed to the particular machine in question it is desirable either to interrupt or prevent the advancement of the recording medium or tape through the mechanism so that the succeeding message will be properly recorded by the receiving instrument.

Various arrangements for accomplishing some of these features have been suggested in the past. These usually require a special transmitter for automatically transmitting special signals upon cessation of the transmission of regular or message signals to advance the tape through the receiving machine or else they employ a modified receiving machine which will so advance the tape through it.

It is an object of the present invention to provide an arrangement which will perform the functions described above without incorporating the inherent disadvantages of the previous systems. For example, the usual recording instruments may be employed which do not need to be modified in any way to cause them to automatically advance the recording medium or tape. In addition, it is not required to utilize valuable line time for the transmission of necessary signals to advance the medium through the recording instrument by transmitting them from the transmitter or by transmitting them from a transmitter adjacent or local to the message transmitting instrument.

It is an object of the present invention to provide a special arrangement intermediate the transmitter and the receiver for automatically causing the transmission of predetermined signals for causing the tape to be advanced through the recording instrument when the recording instrument remains idle for a predetermined short interval of time after it has received a message or other recognizable or distinguishable group of signals.

Another object of this invention is to provide an arrangement for generating signals for advancing the recording medium through receiving instruments which are generally recorded in printed form by the usual recording and receiving instruments employed in telegraph communication networks.

It is frequently desirable to employ recording receiving instruments in combination with telegraph switching systems and more particularly in combination with automatic switching systems. In this case it may be desirable to have the switching equipment cause the receiving instrument to automatically advance a predetermined quantity of record medium out of the receiving machine after it has received a message or other distinguishable group of signals. When so employed it is desirable to stop the automatic operation of the machine at as early a time as possible when and if an additional message is directed to the receiving equipment.

This invention is particularly well adapted and suitable for use in combination with a comprehensive telegraph system such as disclosed in patent application of Bacon et al., Serial No. 383,490, filed March 15, 1941, or patent application of Krecek, Serial No. 408,604, filed August 28, 1941, and also patent application of Branson et al., Serial No. 448,878, filed June 27, 1942, which patent applications are hereby made a part of this application as if wholly set forth and included herein. In systems of this type the receiving equipment at various stations is controlled from a number of secondary switching stations or centers associated with party line extending to the main switching station as set forth in the above-identified patent applications. When the invention is incorporated in one or more of the machines served by party lines of systems of this type, which lines also serve other receiving equipment at other stations, it is desirable to interrupt the operation of the automatic record advancing circuit and apparatus during the selection of any one of the stations to insure that the equipment so advancing the record medium will be idle and available for re-

cording the message should it be the one selected by the selecting equipment. After some other recording instrument has been selected automatic advancement of the record medium through the instrument will be resumed automatically until a desired quantity of record medium following a message is advanced through the recording equipment.

Briefly, in accordance with a specific embodiment of this invention, a telegraph reperforator is controlled from a secondary switching unit connected to a party line and an auxiliary control circuit provided adjacent the secondary switching unit which will automatically transmit a group of letters signals or some other signals not added to any message for a predetermined interval of time and cause them to be transmitted to the reperforating instrument each time the reperforating instrument is operatively disassociated with or disconnected from the party line. For the purposes of this specification and the claims appended hereto, the terms non-intelligence signals and non-message signals are used to describe and designate any signals or permutation code groups which do not form a part of the subject-matter of messages as recorded by the receiving device at the station of the ultimate destination of the message.

During the time any selecting signals for selecting any of the instruments or equipments associated with the party line are being transmitted thereover, the automatic generation and transmission of letters signals to the reperforating instrument is interrupted. After the transmission of the selecting signals over the party line, the auxiliary circuit cooperating with the secondary switching centers is either restored, if the associated reperforator has been selected, or else it will resume the generation of letters signals and transmit them to the reperforator to cause the previously recorded message to be advanced out of the mechanism.

At the end of a predetermined minimum interval of time, the equipment at the control center will operate to interrupt the generation of letters signals and restore the circuits to an idle condition. The circuits will then remain in this condition until the reperforator is disconnected from the receiving channel after it has again been selected and recorded another message.

The foregoing objects and features of this invention may be more readily understood from the following description when read with reference to the drawings in which:

Fig. 1 illustrates the manner in which Figs. 2 through 7, inclusive, are positioned adjacent each other to show the details of the circuits equipped and which cooperate in accordance with this invention;

Figs. 2 through 7, inclusive, show details of a typical telegraph system such as disclosed in the above-identified patent application of Branson et al. to which the improved control arrangement for reperforators has been added and incorporated therein.

The details of the specific apparatus and circuit arrangements disclosed in the drawings and described hereinafter are to merely illustrate the manner in which a typical embodiment of this invention is incorporated in a typical telegraph switching system but these details and equipment are not in any way intended to limit or define the exact scope of this invention as set forth in the claims appended hereto.

As pointed out above, the specific embodiment of the invention described herein and shown in the drawings is adapted to cooperate with the apparatus circuits of the above-identified application of Branson et al.

Figs. 3 and 4 of this application are similar to Figs. 11 and 24 of said Branson et al. application and may be directly substituted for these figures providing that the associated additional equipment shown in detail on the right-hand portion of Fig. 2 is also included with Figs. 3 and 4 of this application. With this addition Figs. 3 and 4 of the present application may be substituted for the corresponding figures in said Branson application without further change. In this case, however, the equipment and apparatus shown in Figs. 3 and 4, as well as the right-hand portion of Fig. 2, will operate as described herein.

The remaining portion of Fig. 2 as well as Figs. 5, 6 and 7 show in outline form the various circuits and apparatus comprising a typical switching system such as set forth in the above-identified Branson et al. application.

It is to be understood that the apparatus and circuits in accordance with the present invention for controlling the advancement of the recording medium through a typing reperforator may be applied to any of the other stations or other typing reperforators incorporated in the system either at other stations served by the same party line or by stations served by different party lines. As is understood by those skilled in the art, typing reperforators may be controlled by any of the secondary switching centers and any of the centers may control one or more typing reperforators. In each case, where desired, an arrangement in accordance with the invention may be provided.

Before describing the operation of the improved control arrangement in accordance with this invention, reference will be made to the other equipment of the system which is described in detail in the above-identified Branson et al. application.

Briefly, the system comprises a plurality of party lines **201** and **560**. These party lines comprise a receiving channel **202** and **561**, respectively, for the transmission of signals from a central switching center shown in Figs. 6 and 7 to the respective stations served by these party lines. The party lines also include a transmission channel **203** and **562**, respectively, for the transmission of signals from the outlying stations to the central switching center. As described in the above-identified application of Branson et al., these party lines may be arranged to operate either on a full duplex or half duplex basis. The party line **201** is assumed to be a full duplex party line, while the line **560** is assumed to be a half duplex party line. As will be well understood by those skilled in the art, any number of full duplex and half duplex lines may be provided. As shown in the drawings, full duplex party line **201** extends to the secondary switching centers **275**, **314** and **513**. These switching centers control the stations **276**, **277**, **278**, and **419**, the receiving reperforators **415** and **410**, and stations **520**, **521**, **522**, **523** and **524**. Party line **560** extends to the secondary control centers **565**, **564** and **563**, which centers in turn control the stations **566** through **574**, inclusive.

Lines **590** represent a channel extending from switching center shown in Figs. 6 and 7 to a second switching center **593**. This channel or trunk includes a channel **591** for transmitting messages from the switching center shown in Figs. 6 and

7 to the second switching center 593 where receiving equipment 594 is associated therewith. The trunk 590 also includes a second channel for transmission of signals from the sending equipment 595 at the second switching center 593 to the central exchange shown in Figs. 6 and 7.

The party lines 201 and 560 as well as the trunk circuit 590 may include any suitable type of telegraph transmission channel. As shown in the drawings, these lines are shown as two one-way full metallic transmission paths in an effort to avoid further complication of the disclosure. It is to be understood, however, that these transmission paths may include one or more of the following types of telegraph transmission systems and in actual practice will usually combine a number of the different following types of transmission paths, as will be readily understood by those skilled in the art. The transmission paths of the different lines will vary from section to section independently of the type of transmission apparatus employed in any of the other lines or trunk circuits.

Briefly, these lines and channels will include both full and half duplex low frequency telegraph lines or channels which may be operated either on a ground return or full metallic basis and which channels may comprise telegraph channels of composited telephone and telegraph lines of any of the well-known composite systems including simplex and phantom circuits as well as so-called Morse legs of cable quads. These channels may also include channels of the so-called time division multiplex telegraph systems for the transmission of signals in either one or both directions.

The telegraph transmission channels may also include channels of voice frequency carrier telegraph systems as well as channels of high frequency carrier current telegraph systems and also radio channels.

These party lines will also include the usual types of terminal and interconnecting equipment for the various types of communication systems employed as well as the usual types of amplifiers and repeaters, including regenerative repeaters, and volume compensator and other control equipment generally employed with systems of the respective types. Inasmuch as the respective types of telegraph systems operate in their usual manner and are well understood by those skilled in the art, they have not been shown in the drawings but merely represented by two one-way telegraph channels for each of the lines of the system.

As set forth in the above-identified Branson et al. application, the party lines terminate at the central exchange in equipment individual to each of the lines. The incoming channel party line 201 terminates in an incoming line circuit 622. The incoming line circuit causes the message to be recorded either by receiving-only teletypewriter 623 when the messages are intended for the central switching station or upon a combined reperforator and transmitter 624 comprising reperforating unit 626 and a transmitting unit 625. The transmitter 625 is associated with the director circuit 627 which controls a crossbar or other type of switch including the selector magnet 628 and the holding magnets 790 and causes the transmitter to be connected to some channel extending towards the party line for which the message is intended.

As described in the said Branson et al. application, each message is preceded by a plurality of address characters which characters control the directing circuit 627 and cause transmitter 625 to be connected to the proper channel extending toward the station of address under control of these address characters. Each of the outgoing lines is provided with one or more channels of transmission through the crossbar switch. The party line 201 is provided with two sets of channels and each channel provided with a group of relays individual thereto illustrated symbolically at 620 and 621. Each of the channels is also provided with a combined reperforating and transmitting instrument 614, 615. The transmitting units of these instruments are arranged to transmit alternately over the receiving channel of the party line 201 and are provided with various control relays 611, 612 and 613. A transmitter start circuit is also associated with the receiving channel or party line 201 for transmitting transmitter start signals or control patterns over this channel. These transmitter start patterns control the switching equipment at the secondary switching center and cause the associated transmitters to be started into operation when they are supplied with stored message material available for transmission.

The secondary switching centers also respond to at least certain of the address characters and cause the receiving equipment controlled by them to be selectively and operatively connected to the receiving channel of the party line in accordance with address characters so that the respective receiving equipment will receive the messages intended for them.

The other party lines of the trunk circuits are similarly equipped with the various circuits as described above. In the case of the half duplex lines only one channel through the crossbar switch will generally be provided since half duplex lines will only be provided when traffic or messages for the stations and line connected thereto are not heavy. No transmitter start circuit has been shown for the trunk circuit because such a circuit generally will be unnecessary since there will be no transmitters to be started under control of the central switching center. With these exceptions the equipment provided for each of the lines and trunks operate in substantially the same manner and perform substantially the same function.

Message originating equipment comprising monitoring teletypewriters 710, keyboard perforators 711, transmitters 712, control relay 713 and director circuit 714 is provided at the central switching station for the transmission of messages from the station to any of the other stations of the system.

In addition, a miscellaneous intercepting circuit 727, receiving reperforator 726 and tape receptacle 725 are provided for the reception of improperly addressed messages and other messages which fail to properly control the switching equipment.

A willful intercept circuit 724 and a combined reperforator and transmitter 720 comprising a reperforator unit 721 and a transmitting unit 722 together with a director circuit 723 are provided for the reception of certain messages intended for stations which it is desired for one reason or another to intercept and prevent transmission to their ultimate station of destination at the particular moment.

The operation of the circuits of such a typical switching system has been described in detail in the above-identified Branson et al. application

and need not be repeated here. It is to be understood, however, that equipment and circuits of this invention cooperate with circuits of said Branson et al. application as will be described hereinafter.

In large switching systems of this type it frequently happens that it is desired to transmit some of the messages to and from other systems of the same or different types or other circuits not forming a part of the main switching system. In order to facilitate the exchange of messages between systems of this type and other systems, reperforators are sometimes employed, and preferably printing reperforators of the type disclosed in U. S. Patents 2,273,909 and 2,273,910, granted to Swan on February 24, 1942; 2,255,794 granted to Lake on September 16, 1941, all of which patents are hereby made a part of this application as if fully included herein, or of the type described in the above-identified Branson et al. application. As described in that application, such a reperforator was shown at or near station **219** thereof. In the present application, two such reperforators **416** and **411** are shown at stations **415** and **410**. These stations may be at the same station or place as station **419** or they may be at other stations in the same local area as station **419**. In either event, the printing reperforators **416** and **411** are controlled from the secondary switching center **314**. In case it is desired to direct a message over some line not a part of the main switching system which terminates at or near station **419**, the message will be preceded by a particular address code which will cause the message to be directed to one or the other of the printing reperforators. As shown in Fig. 4, messages preceded by the address code BK will be directed to the printing reperforator **416**, while messages preceded by the address code BJ will be directed to the printing reperforator **411**. Any other suitable code, of course, may be chosen and the switching circuits appropriately connected as described in the above-identified Branson et al. application. However, when the codes BJ and BK are employed the system will operate without any changes to cause the messages preceded by these codes to be directed to these instruments. The printing and perforating positions in substantially all commercial reperforators and printers are a considerable distance from the edge of the machine. This causes the final portion of the message to be within the machine when the message is terminated and the machine stopped. In case another message immediately follows the first message, the end of the first message will immediately pass out of the machine followed by the second message. However, in case no second message immediately follows the first message, the machine normally will remain at rest until a second message is received. This requires some method of removing the entire first message from the machine in case it is desired to transmit the message over some other circuit prior to the reception of a second message.

In the past it has been customary to manually cause the reperforating machine to advance the record medium and thus the end of the first message out of the machine.

This operation of the machine is frequently designated "feed-out." Manual operation of the feed-out arrangement interferes with the reception of a succeeding message if it should be received at the time of the manual advancing of the record medium through the machine. Generally, such manual control of the machine causes at least the first portion of the following message to be mutilated and generally lost. In addition, the manual control of the machine consumes the operator's time and requires her attention.

In order to eliminate these undesirable features, an automatic feed-out arrangement is provided in accordance with this invention which will cause the machine to automatically advance the record medium through the machine upon the completion of transmission of a message thereto and which will be interrupted by a succeeding message sufficiently early so that the succeeding message will not be in any way altered or mutilated but will be received in its entirety by the receiving reperforator.

Assuming now that the message transmitted over the receiving channel **202** of the party line **201** is intended for the reperforator **416**. This message will be preceded by the address code BK. In addition, assume that the circuits of the secondary switching center **314** are in the position shown in the drawings. They are returned to this position at the end of any previous message transmitted over this system or by the application of power as occurs the first thing in the morning. The permutation code selector **301** follows all of the signals received over the receiving channel **202** and causes certain of the contacts thereof to be selectively controlled or closed in response to the reception of predetermined signals transmitted over this channel.

The manner in which the selector causes the respective contacts to be closed is described in detail in Patents 2,120,235, granted to Beattie et al. on June 14, 1938; 2,112,234, granted to Beattie et al. on March 29, 1938; and 2,154,547, granted to Walker on April 18, 1939, which patents are hereby made a part of this application as if fully included herein. The selector **301** is provided with the line relay **303** which repeats the signals received over the party line to the control or selector magnet **302** which causes the respective contacts to close in response to the reception of the corresponding signals. In case a message is directed to the station BK the letter B of the address code is absorbed by the switching equipment at the central station so that the first code transmitted over the receiving channel will be the one represented by the letter K.

When this code is received by selector **301** with the circuits in the position shown in the drawings, a circuit will be completed for the operation of relay **332** from battery through the winding of relay **332** and the left-hand inner break contacts of relay **304** to ground through the momentarily operated contacts K of selector **301**. Relay **332** in operating completes the circuit for maintaining itself operated and for operating relay **304**. The locking circuit for relay **332** may be traced from the battery through its winding and left-hand inner operated contacts to ground through the left-hand inner break contacts of relay **337** and the right-hand inner operated contacts of relay **332**. The circuit for the operation of relay **304** extends from battery through the winding of relay **304** to ground through the right-hand inner operated contacts of relay **332**.

Relay **304** in operating disconnects the circuits through the contacts of the selector **301** so that when these contacts close, due to the reception of the corresponding codes during the transmission of the succeeding message, the switching circuits will not be altered except as described in the above-identified Branson et al. application.

The operation of relay 332 also extends the contacts of relay 383 to conductor 460 extending to station 415. The succeeding signals transmitted over the party line 201 will then be repeated by relay 383 to the line relay 424 over conductor 460, which relay in turn repeats them to the control magnet 425 of the printing reperforator 416. The printing reperforator 416 then records the signals of the message. The operation of the circuits for establishing this connection to the reperforator 416 as described above is substantially the same as described in the above-identified application of Branson et al.

When it is desired to control the transmitter associated with the line, the transmission of the message to reperforator 416 will be interrupted and later resumed as described in said Branson et al. application without adding any signals to the message, without subtracting any signals from the message, and without mutilating or altering any signals of the message.

The operation of the K contacts of the selector 301, in response to the code combination representing the letter K preceding the message which is directed to the printing reperforator 416, completes a circuit for the operation of relay 250 in addition to completing the circuit for the operation of relay 332, as described above. The circuit for the operation of relay 250 may be traced from battery, to the winding of relay 250 to ground through the momentarily operated contacts K of selector 301. The operation of relay 332, in addition to completing a circuit for maintaining itself operated as described above, also completes the circuit for maintaining relay 250 operated from battery, through the winding of relay 250, the left-hand inner operated contacts of relay 332, the left-hand inner break contacts of relay 337 to ground through the right-hand inner operated contacts of relay 332. The operation of relay 250 connects ground to the lower terminal of condenser 261 and thus completely discharges this condenser. The operation of relay 250 also connects ground to the right-hand terminal and lower winding of relay 253, thus maintaining this relay in the position shown in the drawings.

The operation of relay 250 also completes an obvious circuit for the operation of relay 251. Relay 251 in operating completes a circuit for maintaining itself operated under control of relay 256 from battery through the winding of relay 251, the left-hand break contacts of relay 256 to ground, through the right-hand inner operated contacts of relay 251. Thereafter the circuits remain in the condition described during the transmission of the message to the printing reperforator 416 at station 415.

At the conclusion of the message an end-of-message signal is transmitted over the receiving channel 202 of party line 201, as described in detail in the above-identified Branson et al. application. This end-of-message signal comprises a figures signal, followed by an H signal and the H signal is generally followed by a letters signal to provide sufficient time for the switching circuits to properly function, as described in the above-identified Branson et al. application.

The FG contacts of the selector 301 close in response to the reception of the figures signal. Closure of these contacts completes the circuit for the operation of relay 345 from battery, through the lower winding of relay 346, through the right-hand winding of relay 345, to ground, through the momentarily closed contacts FG.

Relay 345 in operating completes a circuit for maintaining itself operated, from battery, through its left-hand winding, the left-hand outer break contacts of relay 337 and the outer right-hand and outer left-hand operated contacts of relay 345, to ground, through the right-hand contact and armature of relay 346. Inasmuch as the upper circuit and the winding of relay 346 are not closed until relay 345 operates, at which time current also flows through the lower winding of this relay, relay 346 will remain in the position shown in the drawings. A short interval of time prior to the opening of contacts FG, the UN contacts will open and interrupt the circuit through the upper winding of relay 346 so that when the FG contacts open and interrupt the circuit through the lower winding of this circuit, the relay will maintain its armature in the position shown and maintain the locking circuit of relay 345 closed.

If the signal following the figures signal is other than another figures signal, an H signal, or a blank signal, relay 346 will operate in response thereto and interrupt the locking circuit of relay 345. However, if the succeeding signal is an H signal, the H contacts of selector 301 will be momentarily closed and complete a circuit for the operation of relay 337, from battery, through the lower winding of relay 346, the winding of relay 337, left-hand inner operated contacts of relay 345, to ground, through the momentarily closed H contacts.

A short interval of time after the H contacts close, the UN contacts will close to complete a circuit through the upper winding of relay 346. Current flowing through the upper winding of relay 346 tends to operate the armature of this relay to its left-hand position, but the effect of this current is overcome by the effect of the current flowing through the lower winding of this relay, thus maintaining its armature in the position shown. A short interval of time before the H contacts open, the UN contacts open to interrupt the circuit through the upper winding of this relay before the circuit of the lower winding is interrupted. Thus, this relay will be maintained in the position shown in the drawings.

Relay 337 in operating completes a circuit for maintaining itself operated from battery, through the lower winding of relay 346, winding and right-hand inner operated contacts of relay 337, the right-hand and left-hand outer operated contacts of relay 345 to ground, through the right-hand contact and armature of relay 346. Relay 337 in operating also interrupts the locking circuit of relay 345 which permits this relay to release. The release of relay 345 interrupts the locking circuit of relay 337, which permits this relay to release when the H contacts open after the reception of the H signal.

The operation of relay 337, however, interrupts the locking circuit of both relays 332 and 250 traced above, whereupon both of these relays release prior to the release of relay 337.

The release of relay 332 interrupts the operating circuit of relay 304. The release of relays 332, 304, 345 and 337 restores the switching circuits to their normal or idle condition, as set forth in detail in the above-identified Branson et al. application.

The release of relay 250 completes the circuit for energizing the filament or cathode of tube 257 from ground, through the right-hand outer break contacts of relay 250, right-hand outer operated contacts of relay 251, through resist-

ances 267 and the cathode circuit of tube 257 to battery.

The release of relay 250 also removes ground from the lower terminal of condenser 261. This terminal of condenser 261 then starts to charge through high resistance 266.

The constants of tube 257 together with the battery potential, resistances 267, condenser 261 and resistance 266 are such that no anode current will flow through tube 257 for some appreciable predetermined interval of time as, for example, fifteen seconds.

During this fifteen-second time interval, however, the release of relay 250 connects ground to the armature of relay 254 and to the upper terminal of resistance 264. The circuit from the upper terminal of resistance 264 may be traced through the center left-hand operated contacts of relay 251 and the left-hand inner break contacts of relay 250 to ground. Completion of this circuit causes the armature of relay 254 to operate to its right-hand position due to current flowing from battery through the upper winding of relay 254, through resistance 264 to ground, through the left-hand contacts of relays 250 and 251 in the circuit described above.

Release of relay 250 also interrupts the circuit in the lower winding of relay 253 and thus permits this relay to operate as described hereinafter.

The operation of relay 254 to its right-hand position due to the current flowing in its upper winding as described above connects ground to the right-hand terminals of both its upper and lower windings through its right-hand contact and armature and the center left-hand operated contacts of relay 251 and the left-hand inner break contacts of relay 250. The connection of ground to the right-hand terminal of the upper winding of this relay reverses the flow of current through this winding so that the current now flows through resistance 265 and the upper winding of relay 254 to ground through its right-hand contact and armature in the circuit traced above. The current flowing through its upper winding at this time will thus tend to move the armature of this relay to its left-hand position.

However, it is prevented from doing so at this time due to the fact that condenser 259 discharges through the lower winding of relay 254 in such a direction as to tend to maintain its armature in the right-hand position until the discharging current of condenser 259 falls below the value required to maintain the armature of relay 254 in its right-hand position. At this time current flowing through the upper winding of relay 254 will overcome the effect of the current flowing through the lower winding of this relay and will cause its armature to move to its left-hand position as shown in the drawings.

When the armature of relay 254 leaves its right-hand contact, ground will be disconnected from the right-hand terminal of the upper and lower windings of this relay and battery will then be connected thereto. Under these conditions current through the upper winding of this relay will again reverse and tend to move its armature to its right-hand position. At this time, however, it is prevented from doing so due to the charging current of condenser 259 flowing through the lower winding of relay 254. At the end of the predetermined interval of time determined by the constants of the relay and circuit of condenser 259, the charging current of condenser 259 will fall to such a value that the armature of relay 254 will again be operated to its right-hand position. Thereafter the above cycle of operation of relay 254 will be repeated and the relay will operate alternately to its right-hand and left-hand positions.

It should be noted that the left-hand terminal of the upper winding of relay 254 is connected to the common point of resistances 264 and 265. Resistances 264 and 265 comprise a potentiometer which causes the current to reverse in the upper winding of relay 254 as described above. By properly choosing the values of resistances 264 and 265 it is possible to control the portion of time the armature rests against each of the contacts since the magnitude of the current flowing through the upper winding of this relay need not be the same when the relay is in its two positions. In the preferred embodiment of the invention the values of the resistances and constants of the relay 254 and condenser 259 are so chosen relative to the signaling speed of the system or apparatus that relay 254 will be maintained in its left-hand position only a relatively short interval of time while it will be maintained in its right-hand position for an interval of time of six and one-half to seven times as long.

During the time relay 254 is operated to its left-hand position it connects ground to the left terminal and condenser 260 and thus tends to discharge this condenser. The discharge current of condenser 260 flows through the upper winding of relay 253 in such a direction as to operate relay 253 to its right-hand position where it applies spacing potential to conductor 268 which is connected through the right contacts of relay 332 to the transmission conductor 460 extending to the reperforator 416. A short interval of time later when relay 254 is operated through its right-hand position, it interrupts the circuit through its left-hand contacts to the left-hand terminal of condenser 260 whereupon this terminal of condenser 260 starts to charge. The charging current of condenser 260 also flows through the upper winding of relay 253 but in the opposite direction from the discharge current. Consequently the armature of relay 253 is moved to its right-hand position where it again applies marking potential to conductor 268 which extends over the line 460 to the reperforator 216. Thus, potentials of alternately spacing and marking potential are applied to line 460 extending to the reperforator 416.

When the relays operate as indicated above, the spacing potential is applied to the line for a relatively short interval of time which in the preferred embodiment of this invention is approximately equal to the length of the unit impulse of the code employed. Thereafter the marking polarity or the marking condition is applied to the conductor for an interval of time approximately equal to the time required for the transmission of six or six and one-half unit impulses of the code employed. Thus, a spacing condition is transmitted to the reperforator 416 for approximately one code interval and then marking potential is applied for six or six and one-half unit intervals of time and then this cycle is repeated. As will be understood by those skilled in the art, the actual lengths of time will vary depending upon the signaling speed of the system or apparatus.

This cycle of impulses when received by the reperforator 416 will be interpreted by it as representing a letters signal. In other words, the spacing impulse will be interpreted as a start signal and the following marking impulses will be

interpreted as five marking impulses followed by a stop impulse of one and one-half or more intervals of time; in this case the system employs the so-called seven and one-half unit code. If the seven-unit code is employed then the interval of time during which marking impulses or signaling conditions are transmitted may be slightly reduced. However, it is desirable to make the marking conditions slightly longer than the minimum length of time required to send the required number of marking impulses to insure that the reperforator 416 will be actually synchronized each time with the signals transmitted.

In other words, relay 254 together with relay 253 operates to generate the series of letters signals which are transmitted to and recorded by the reperforator 416 immediately following the message recorded by this reperforator.

The reperforator responds to these letters signals by punching the tape in accordance with them. However, in the preferred embodiment of this invention this instrument does not print any character or symbol in response to these signals. However, these instruments may be arranged to print any character or symbol in response to these signals or any other signals may be generated which will cause the printing mechanism to print any desired symbol or character.

The action of the circuits in generating and transmitting letters signals to the reperforator 416 will then continue so long as no signals are received over the receiving channel 202 of the party line 201 or until the end of the time interval for charging of condenser 261 to a value sufficient to cause anode current to flow through tube 257. At the end of this time interval, which may be of the order of fifteen seconds, as pointed out above, the lower terminal of condenser 261 will be charged to a sufficiently positive potential to cause tube 257 to pass sufficient anode current to operate relay 255. The operation of relay 255 completes an obvious circuit for the operation of relay 256. Relay 256 connects ground to the right-hand terminal of the lower winding of relay 253 and thus maintains the armature of this relay in the position shown in the drawings and interrupts the transmission of letters signals to the reperforator 416. The operation of relay 256 also interrupts the locking circuit of relay 251, which relay releases and deenergizes the filament circuit of tube 250 and thus restores this tube to normal and causes relays 255 and 256 to release. The release of relay 251 also interrupts the circuit to ground from the armature of relay 254 and from resistance 264, thus restoring the circuits of relay 254 to their normal or idle condition.

The circuits will then remain in the idle condition until the message is again directed to the reperforator 416 at which time the operation of the circuits, as described above, will be repeated. During the fifteen-second time interval following the transmission of the message to this instrument a series of letters signals will be generated and transmitted to this recording device to advance the end of the message out of the machine so that it may be readily removed in its entirety and taken to some transmitting apparatus or employed in any other desirable manner.

If at any time during this fifteen-second time interval signals are received over the transmitting channel 202 of party line 200 the transmission of these letters signals will be interrupted. If the succeeding message is intended for reperforator 416 the circuits for generating the letters signals will be restored to the condition described above during the reception of the messages by the reperforator 416.

If the succeeding message is intended for some other receiving instrument of the party line 260 the operation of the circuits for automatic generation of letters signals will be resumed upon the operation of the circuits so controlling the receiving devices.

If during the time letters signals are being automatically generated and transmitted to reperforator 416 as described above any signals are transmitted over the receiving channel of party line 202, relay 205 which is connected to this channel in responding to them will complete a circuit through the lower winding of relay 252 for moving the armature of this relay to its right-hand position and also for discharging condenser 258. This circuit extends from battery through the lower winding of relay 252, contacts of testing jack 263, the left-hand outer operated contacts of relay 251 and the left-hand outer break contacts of relay 250 through the armature and right-hand or spacing contact of relay 205 to ground through the left outer break contacts of relay 304.

Relay 205 in following these signals transmitted over the receiving channel 202 will cause its armature to be moved to its spacing condition in response to the spacing impulses of the signals transmitted over this channel and establish the circuit described above. During intervals when marking impulses are transmitted over the receiving channel 202 the armature of relay 205 will be operated to its left-hand position where it interrupts the circuit to the lower winding of relay 252. At this time, however, condenser 258 will charge through the lower winding of relay 252 in such a direction as to maintain the armature of relay 252 in its right-hand position and prevent the transmission of letters signals to the reperforator 416. The constants of condenser 258 and relay 252 are such that the armature of relay 252 will be maintained in its right-hand position due to relay 205 responding to the signals transmitted over the receiving channel 202. At the end of these signals condenser 258 starts to charge through the lower winding of relay 252 and after condenser 258 has been charged sufficiently, the current flowing through the lower winding of relay 252 will fall to such a value that current flowing through the upper winding of this relay will move its armature to its left-hand position thus interrupting the circuit through the lower winding of relay 253 and permitting the transmission of letters signals to be resumed.

If the signals transmitted over the receiving channel during the interval in question cause any other receiving instrument served by the channel to be selected to receive the following messages, relay 304 will operate upon the selection of that instrument and interrupt the circuit to the contacts of relay 205 and the lower winding of relay 252. Upon the charging of the condenser 258, as described above, the armature of relay 252 will be operated to its left-hand position whereupon the transmission of letters signals to the reperforator 416 will be resumed until the end of the interval measured by condenser 261 and tube 257 as described above whereupon the circuits will be restored to their normal or idle condition as set forth above.

If the signals received over the channel 202 during the time the letters signals are being transmitted to the reperforator 416 are intended for the reperforator 416, relay 205 will respond

and immediately suspend the transmission of letters signals, and the subsequent operation of relay **332** and relay **250** as described above will establish the connection for the reperforator **416** and restore the circuits of Fig. 2 to the condition described above.

By immediately stopping the automatic transmission of letters signals to the reperforator **416** upon the first operation of relay **205**, as described above, sufficient time is provided before the message is directed to the instrument to insure that this instrument will be at rest when the first signal of the message is transmitted to it and thus insure that the first character of the message will be properly recorded by this instrument.

In case a message is directed to the reperforator **411** the circuits comprising relays **210**, **211**, **212**, **213**, **214**, **215**, and **216** operate in substantially the same manner as the circuits described above with reference to reperforator **416**. When messages are directed to both of these machines due to the operation of relay **348** or a similar relay, letters signals will be transmitted to both of these machines at the end of the message in the same manner as described above.

Similar circuits may be provided at any or all of the other secondary switching centers for controlling any or all of the recording instruments controlled therefrom, as will be readily understood by those skilled in the art.

While the invention has been embodied in an arrangement suitable for use in a particular switching system, it will be appreciated by those skilled in the art that it may be readily embodied in arrangements suitable for use in other systems.

What is claimed is:

1. In combination, an incoming channel of telegraphic transmission, a reperforator operated under control thereof, a selector separate from the said reperforator associated with said channel, and means under the control of said selector operable responsive to an end-of-message signal for supplying to said reperforator a plurality of non-intelligence code combinations.

2. In combination, a telegraph transmission channel, transmitting apparatus connected thereto for transmitting messages thereover, a recording instrument for recording permutation code signals upon a record medium, and apparatus associated with said channel intermediate said message transmitter and said recording instrument for transmitting a plurality of permutation code signals to said recorder which do not form part of any message for causing said recorder to advance the record medium therethrough.

3. In a telegraph system, a channel of telegraphic transmission, a reperforator, a permutation code selector separate from said reperforator connected to said channel for disconnecting said reperforator from said channel under control of permutation code signals received from said channel, and apparatus operative incident to the disconnection of said reperforator from said channel for transmitting a plurality of predetermined permutation code signals to said reperforator.

4. In a telegraph system, a channel of telegraphic transmission, a reperforator, a permutation code selector separate from said reperforator connected to said channel for disconnecting said reperforator from said channel under control of permutation code signals received over said channel, apparatus operative incident to the disconnection of said reperforator from said channel for transmitting a plurality of predetermined permutation code signals to said reperforator, and apparatus responsive a predetermined interval of time after disconnection of said reperforator from said channel for stopping the transmission of said predetermined code combinations.

5. In a telegraphic system, a channel of telegraphic transmission, a reperforator, a permutation code selector separate from said reperforator connected to said channel for disconnecting said reperforator from said channel under control of permutation code signals received from said channel, apparatus operative incident to the disconnection of said reperforator from said channel for transmitting a plurality of predetermined permutation code signals to said reperforator, and apparatus responsive to the transmission of additional signals over said channel for interrupting the transmission of said predetermined character to said reperforator.

6. In a telegraph system, a channel of telegraphic transmission, a plurality of recording instruments, a plurality of permutation code selectors connected to said channel for selectively controlling the operation of said recording instruments in response to permutation code signals received from said channel, apparatus operative following the transmission of a message to one of said recording instruments under control of one of said selectors for transmitting additional permutation code combinations to said recording instrument.

7. In a telegraph system, a channel of telegraphic transmission, a plurality of recording instruments, a plurality of permutation code selectors connected to said channel for selectively controlling the operation of said recording instruments in response to permutation code signals received from said channel, apparatus operative following the transmission of a message to one of said recorders under control of one of said selectors for transmitting non-message permutation code combinations to said recorder, apparatus responsive to further signals transmitted over said channel for interrupting the transmission of said non-message signals to said recorder.

8. In a telegraph system, a channel of telegraphic transmission, a plurality of recording instruments, a plurality of permutation code selectors connected to said channel for selectively controlling the operation of said recording instruments in response to permutation code signals transmitted over said channel, apparatus operative following the transmission of a message to one of said recorders under control of one of said selectors for transmitting non-message permutation code combinations to said recorder, apparatus responsive to further signals transmitted over said channel for interrupting the transmission of said non-message signals to said recorder, and apparatus operative incident to the direction of a message to another recorder for resuming the transmission of said non-message signals to said recording device.

9. A telegraph system comprising a plurality of telegraph receiving instruments including a reperforator, a plurality of permutation code selecting instruments, a channel of telegraphic transmission extending to all of said selecting instruments, switching apparatus controlled by said selecting instruments for selectively extending said channel to said receiving instruments, apparatus operating incident to the disconnection of said reperforator from said channel for

transmitting a plurality of predetermined permutation code combinations to said reperforator, and apparatus responsive to additional signals transmitted over said channel for interrupting the operation of said apparatus.

10. A telegraph system comprising a plurality of telegraph receiving instruments including a reperforator, a plurality of permutation code selecting instruments, a channel of telegraphic transmission extending to all of said selecting instruments, switching apparatus controlled by said selecting instruments for selectively extending said channel to said receiving instruments, apparatus operating incident to the disconnection of said reperforator from said channel for transmitting a plurality of predetermined permutation code combinations to said reperforator, apparatus responsive to additional signals transmitted over said channel for interrupting the operation of said apparatus, and signal responsive instrumentalities operative incident to the extension of said channel to some other one of said receiving instruments for causing said apparatus to resume the transmission of said predetermined permutation code combination.

11. In combination, a telegraph transmission channel, transmission apparatus connected thereto for transmitting telegraph signals thereover, a printing device for printing symbols upon a record medium in response to telegraph signals received over said channel, and apparatus associated with said channel intermediate said message transmitter and said printing device for transmitting a plurality of telegraph signals to said device for causing said printing device to advance the record medium therethrough without printing any symbols thereupon.

12. In combination, a telegraph transmission channel, transmission apparatus connected thereto for transmitting telegraph signals thereover, a printing device for printing symbols upon a record medium in response to telegraph signals received over said channel, and apparatus associated with said channel intermediate said message transmitter and said printing device for causing said printing device to print symbols on said record medium which do not form part of any message for advancing said medium through said printing device.

13. In a telegraph system, a channel of telegraphic transmission, a recording device for recording permutation code signals upon a record medium, and apparatus associated with said channel for generating a plurality of predetermined signals for causing said recorder to advance the record medium through said recording device, and means controlled solely by predetermined signals received from said channel for initiating the operation of said apparatus for generating a plurality of predetermined signals.

WALTER M. BACON.
RITA SMITH KINKEAD,
Administratrix of the Estate of Fullerton S. Kinkead, Deceased.