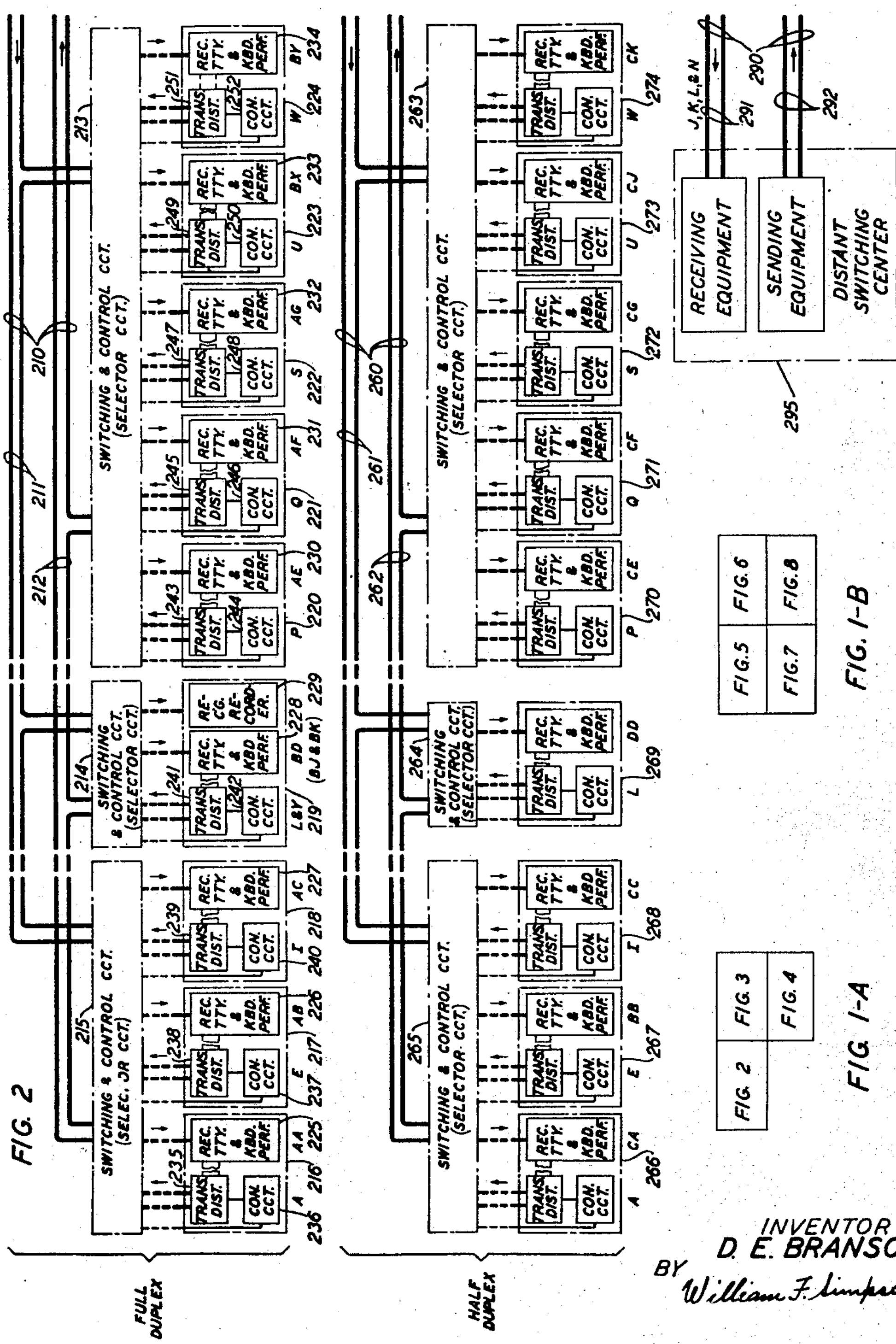
Aug. 14, 1945. D. E. BRANSON 2,382,128

TELEGRAPH SWITCHING SYSTEM

Filed Dec. 7, 1943 7 Sheets-Sheet 1



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TELEGRAPH SWITCHING SYSTEM

Filed Dec. 7, 1943 7 Sheets-Sheet 2

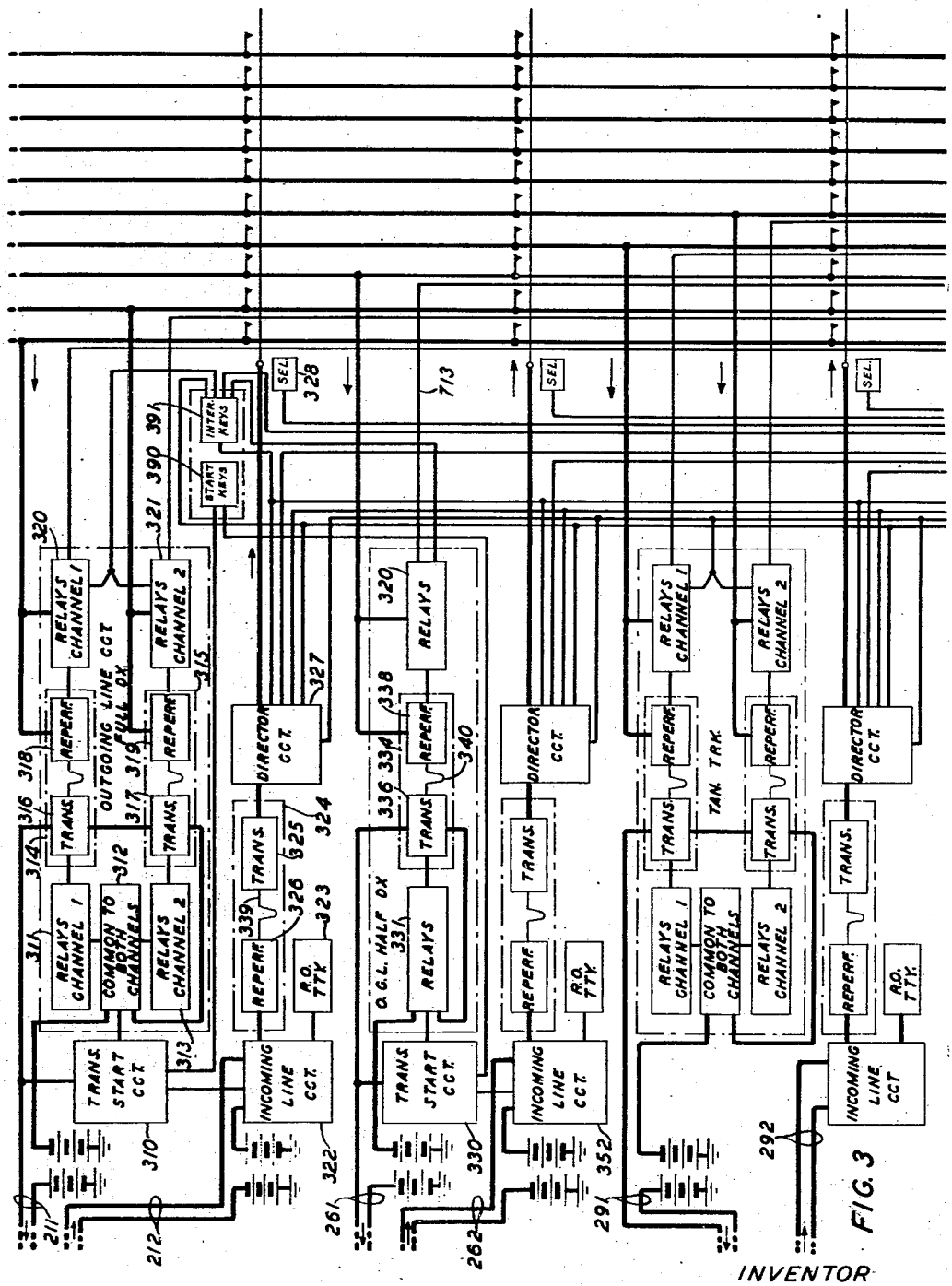

FIG. 3

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TELEGRAPH SWITCHING SYSTEM

Filed Dec. 7, 1943 7 Sheets-Sheet 3

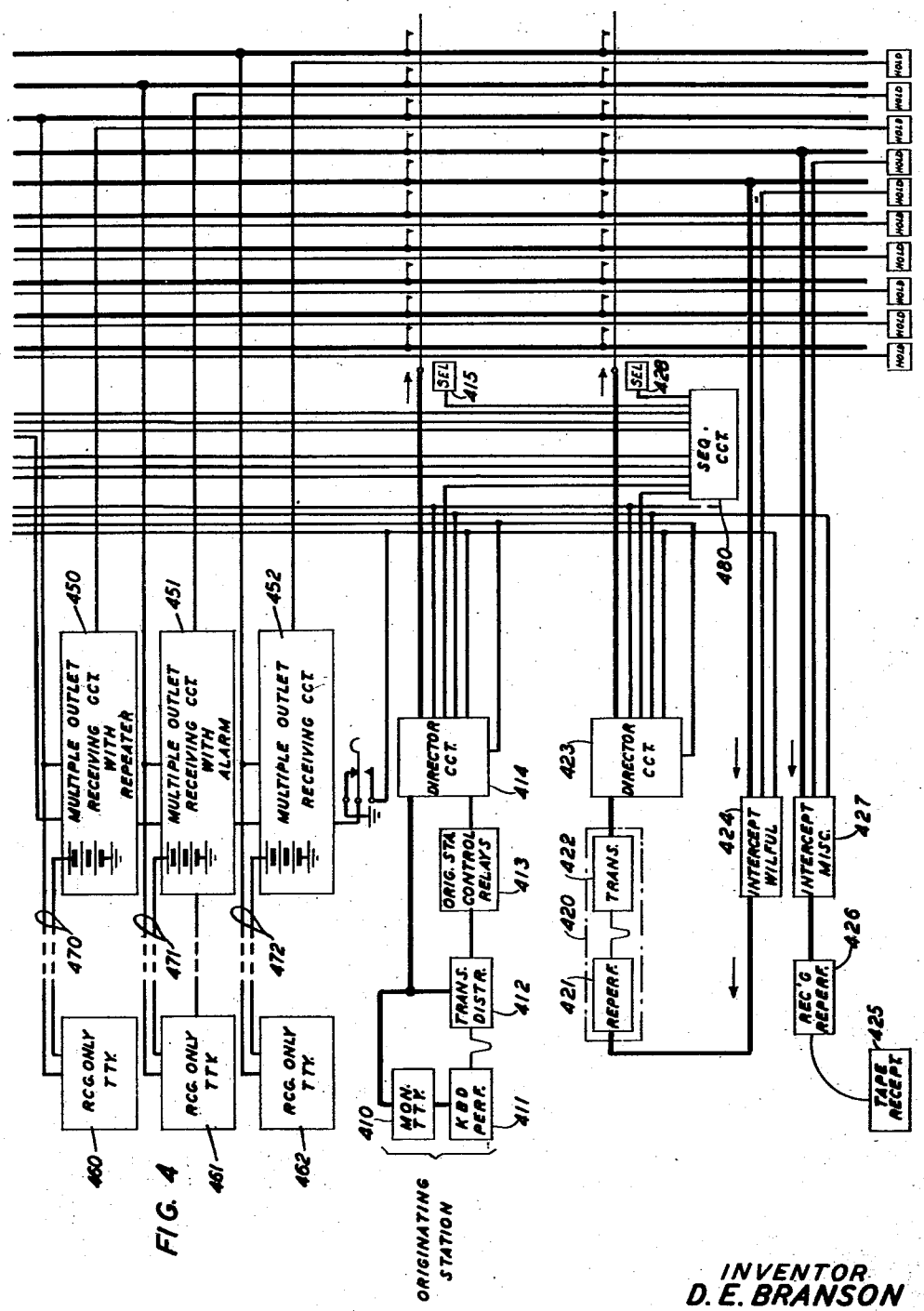

FIG. 4

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TELEGRAPH SWITCHING SYSTEM

Filed Dec. 7, 1943 7 Sheets-Sheet 4

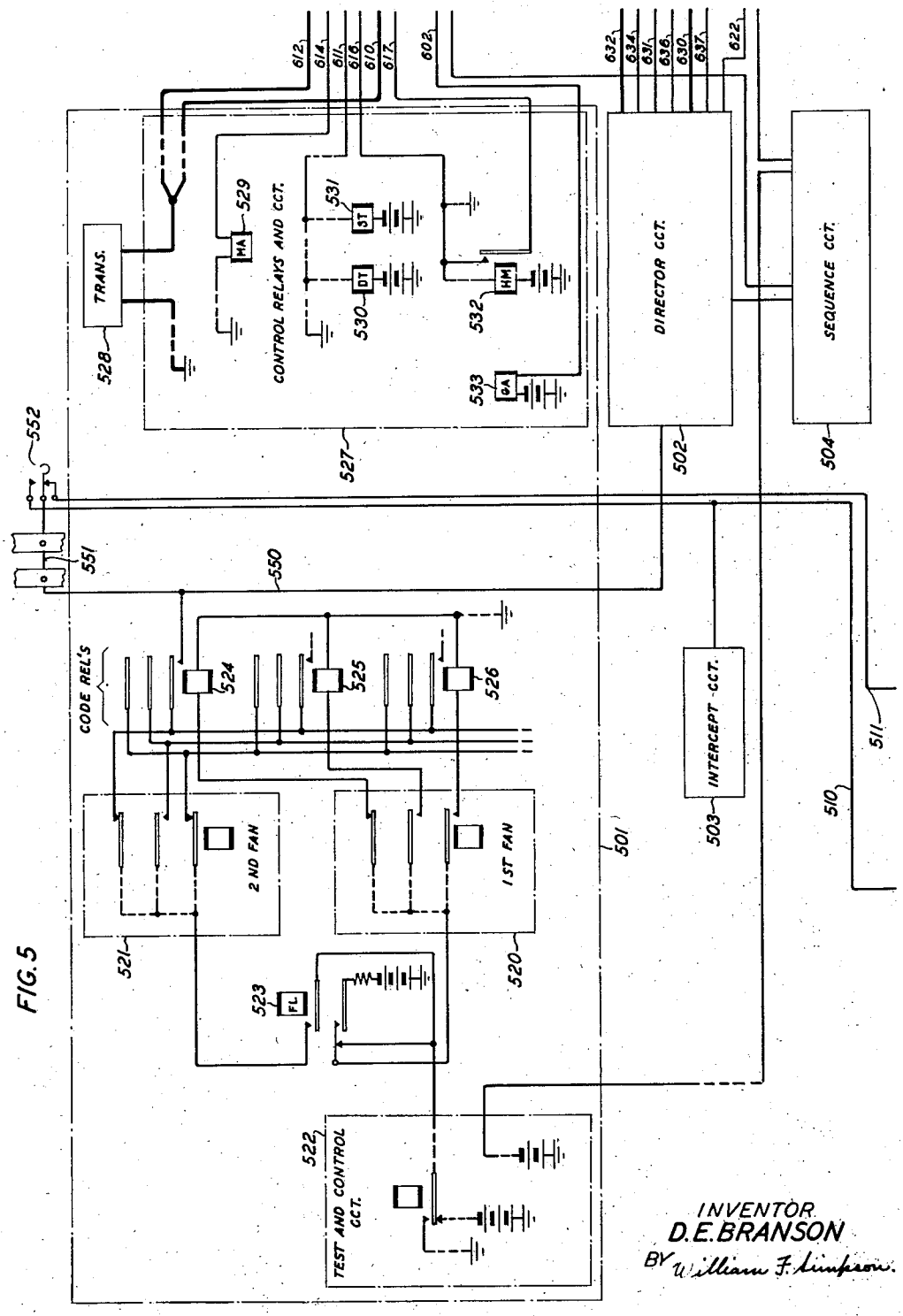

FIG. 5

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TELEGRAPH SWITCHING SYSTEM

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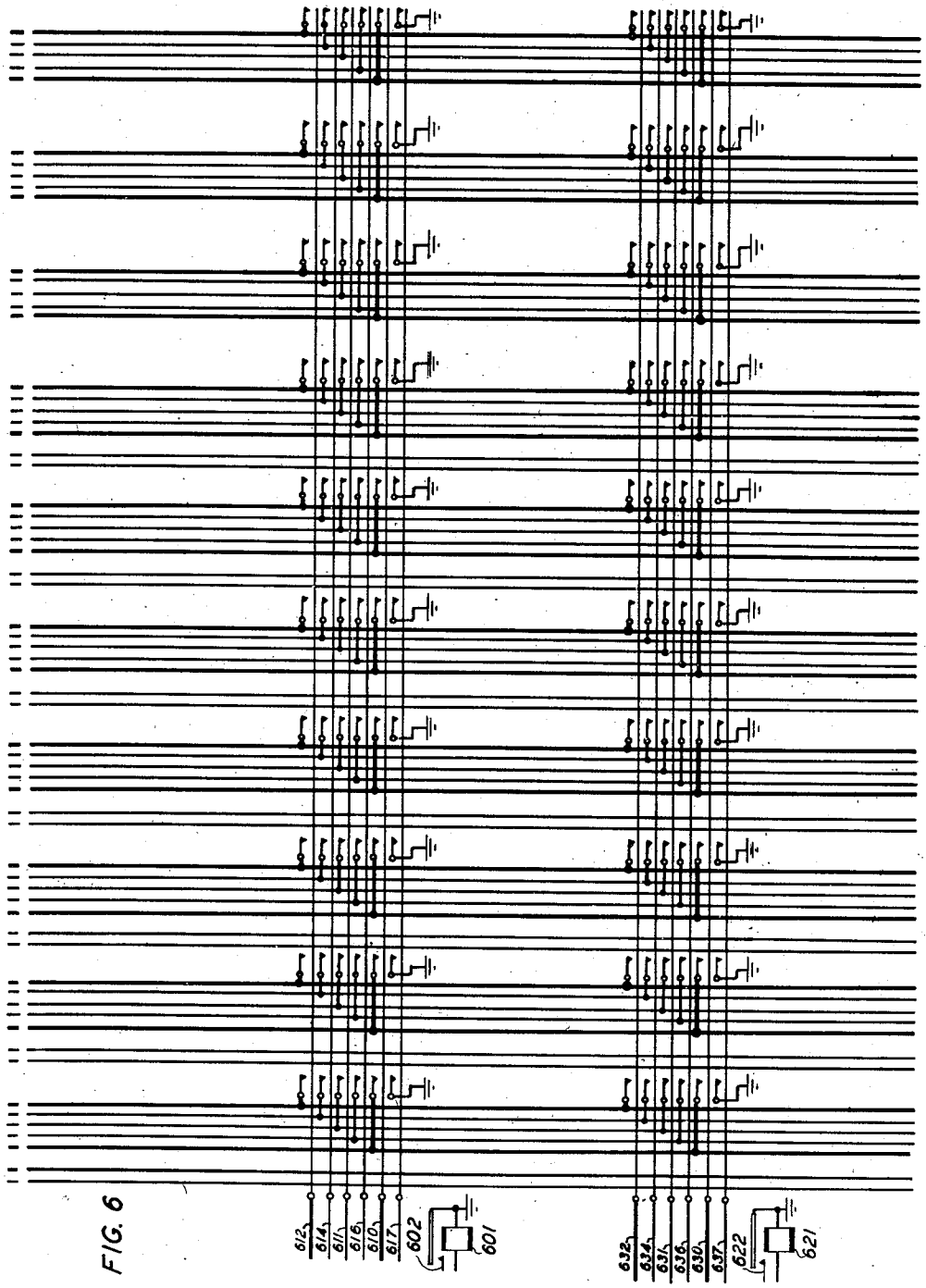

FIG. 6

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TELEGRAPH SWITCHING SYSTEM

Filed Dec. 7, 1943 7 Sheets-Sheet 6

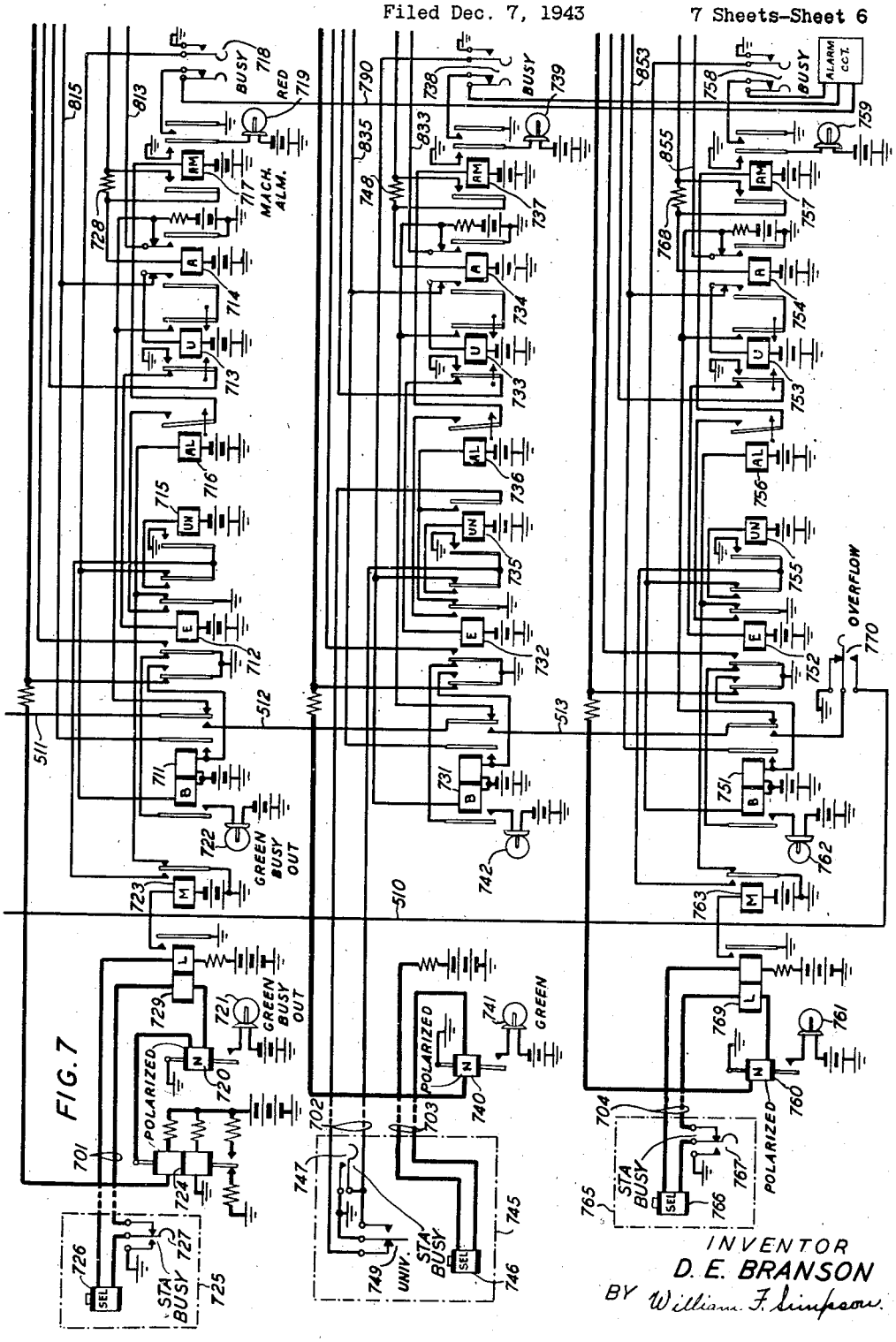

FIG. 7

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TELEGRAPH SWITCHING SYSTEM

Filed Dec. 7, 1943 7 Sheets-Sheet 7

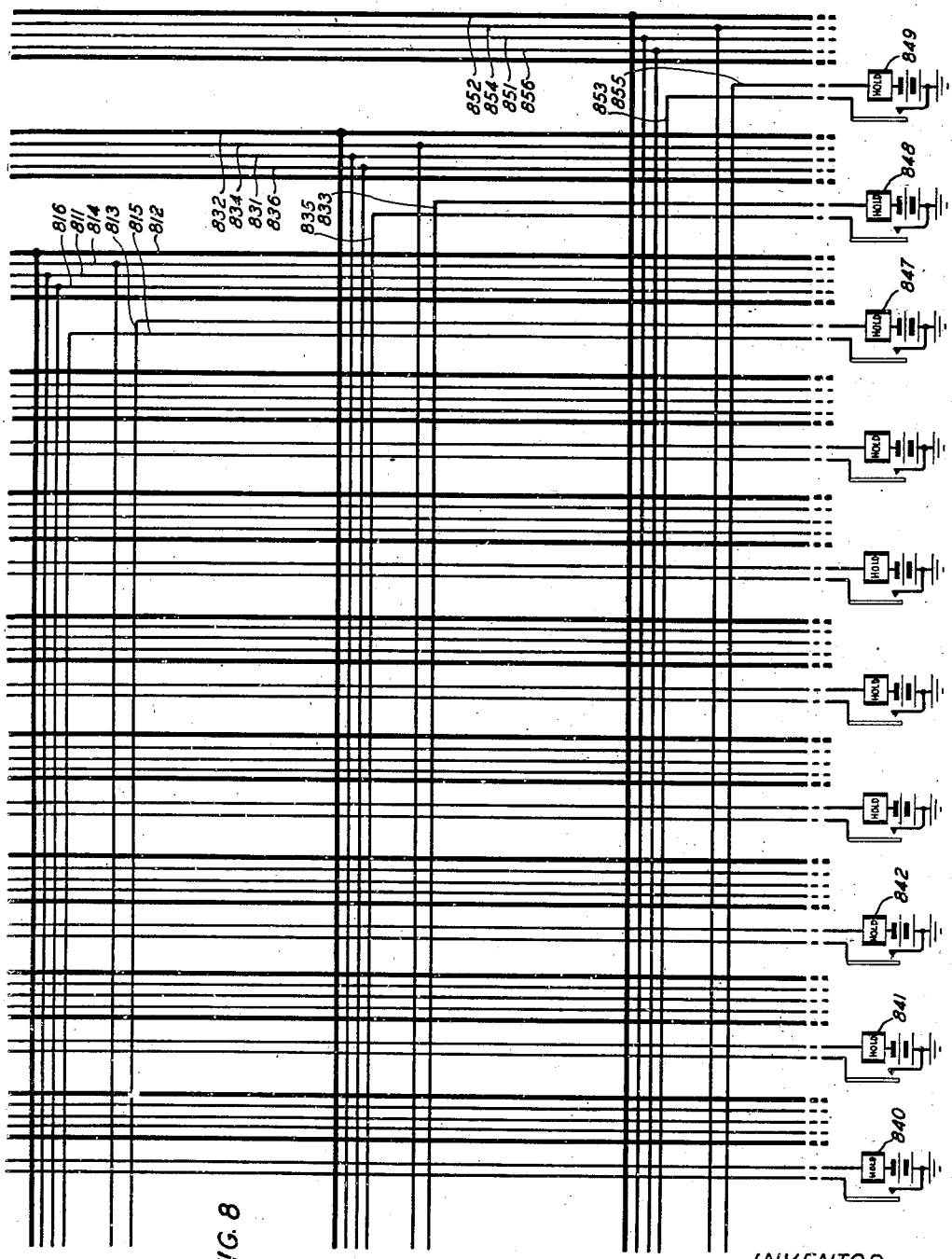

FIG. 8

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Patented Aug. 14, 1945 2,382,128

UNITED STATES PATENT OFFICE

2,382,128

TELEGRAPH SWITCHING SYSTEM

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Application December 7, 1943, Serial No. 513,246

9 Claims. (Cl. 178—4)

This invention relates to communication systems and more particularly to automatic telegraph switching systems in which storage controlled telegraph transmitting apparatus at outlying telegraph stations is automatically set into operation for transmitting stored messages from the outlying stations to the central switching station under control of equipment at the central switching station. The object of the present invention is to provide an improved telegraph switching system having increased flexibility in the manner of directing and controlling the transmission therethrough.

In accordance with an exemplary embodiment of the invention, the system disclosed in United States patent application of Branson et al., Serial No. 448,878, filed June 27, 1942, has been improved by providing multiple outlet circuits therefor.

A multiple outlet circuit is a circuit arrangement which may be provided either at the central switching station or relatively close thereto to which a large volume traffic is directed by a central switching equipment. In accordance with the present invention means have been provided, for said stations to which the volume of traffic thereto is sufficient to fully load more than one transmission path and receiving instrument located at said station, to direct messages to said stations over a plurality of paths.

In accordance with the system disclosed in the said Branson application, means are provided to enable the operator or attendant at the central switching station to start at will the transmitter associated with the lines extending from the central switching station, provided that line is not engaged in the transmission of a message from some transmitter to the central switching station. Means are also provided to interrupt transmission from any transmitter to a central switching station and thereafter initiate transmission from any other transmitter. In that application means are also disclosed for automatically testing the transmitters for stored material available for transmission to the central switching station and initiating transmission over the transmitter provided to transmit such message material in rotation one at a time.

A system disclosed in the said copending Branson et al. application provides apparatus for automatically directing messages received from said switching station through switching equipment located there at over one or more paths through the switching equipment associated with the respective outgoing lines. In the exemplary system described in said application, one or two transmission paths individual to each outgoing line are selectable by the switching equipment and each path is provided with storage equipment for storing messages directed to said line for the subsequent transmission over said line one at a time.

In accordance with the present invention, an additional and different circuit is provided to handle messages directed through the switching equipment to some station or stations which receive a large number of messages. In accordance with the exemplary embodiment of the invention described herein, a plurality of outgoing lines are provided which enable a plurality of transmission paths to extend from the switching system to a receiving device individual to each path extending to the local station over which a large volume of traffic is directed. These additional transmission paths are adapted to cooperate with the switching equipment of the system disclosed in said Branson et al. application without requiring alteration thereof and without requiring the use of storage equipment in any of the additional paths.

The foregoing and other objects and features of the present invention, the novel features of which are specifically set forth in the claims appended hereto, may be more readily understood from the following description when read with reference to the attached drawings in which:

Fig. 1*a* shows a manner in which Figs. 2, 3 and 4 should be arranged adjacent one another to show in outline form various circuits and equipment of an exemplary system in accordance with the present invention as well as to illustrate the routes for the transmission of messages through the system;

Fig. 1*b* shows the manner in which Figs. 5, 6, 7 and 8 should be arranged adjacent one another to show the circuit arrangements in detail in an exemplary form of the invention;

Figs. 2, 3 and 4 when arranged as shown in Fig. 1*a* show a typical telegraph system embodying an exemplary form of the present invention;

Figs. 5, 6, 7 and 8 show the circuit details of an exemplary embodiment of the invention which cooperates with the system disclosed in the above-identified application in Branson et al.

Referring now to Figs. 2, 3 and 4 when arranged as shown in Fig. 1*a*, Fig. 2 shows two typical party lines and the stations and control equipment associated therewith. One party line is designated 210, which comprises a receiving

channel 211 and a transmitting channel 212. Party line 210 is arranged to operate as a full duplex party line. That is, a party line in which messages may be transmitted to any one of the stations at the same time messages are being transmitted from that or any other station of the party line.

Similarly, party line 260 comprises a receiving channel 261, a transmitting channel 262. Party line 262 may be operated on a half duplex basis; that is, transmission may take place over a party line in only one direction at a time, namely, either from any one of the stations of the party line or to any one of the stations of the party line, but not in both directions simultaneously.

Both the transmitting and receiving channels are illustrated in Figs. 2 and 3 by means of telegraph lines or conductors. It should be understood, however, that these lines or channels may be of any type of telegraph transmission equipment normally employed for the transmission of code combinations or pulses. For example, these lines or channels may include open wire lines, cable lines, channels of voice frequency or high frequency carrier current systems, radio systems, channels of division multiplex systems, submarine cable systems, or telegraph channels of composite telephone or telegraph systems, or any other type of pulse transmission suitable for transmission of signal pulses such as are employed in telegraph signals. Various party lines and channels thereof may include or comprise any or all of the foregoing transmission systems in any or all combinations of said transmission systems. These transmission systems may also include the usual types of repeating, regulating, controlling and interconnecting equipment normally employed in the respective systems and employed in interconnecting the various types of systems. Transmission systems of the various types which comprise party lines are operated in a usual and well-understood manner so a description of the operation thereof need not be included herein because it would serve no useful purpose and only tend to obscure the other elements of the features of the present invention.

Each of the party lines shown in Fig. 2 extends to a plurality of outlying subscribers' or way stations. It is to be understood that it is within the scope of this invention to extend lines individually from any one or more of the outlying stations to the central switching station. In this case, certain of the control equipment associated with each of the party lines need not be provided as will be readily apparent to those skilled in the art.

Each of the lines which extends to more than one outlying station is provided with control equipment located at or near the outlying station of the party line. The control equipment may be provided which is individual to each of the outlying or way stations in case the way stations are rather widely separated or the control may be provided common to a group of outlying stations which are located more closely together. Furthermore, certain control equipment may be individual to certain stations while other control equipment provided for the same party line may be common to a plurality of outlying stations.

In the exemplary embodiment of the invention disclosed herein three separate and distinct sets of switching and control systems sometimes referred to as secondary switching circuits are associated with each of the party lines shown in Fig. 2. For example, party line 210 extends to the switching and control circuits or secondary switching centers 213, 214 and 215. Control equipment 214 is individual to station 219. Control equipment 215 is common to stations 216, 217 and 218, while control equipment 213 is common to stations 220 to 224, inclusive.

Each of the outlying stations is provided with a receiving instrument, a transmitting instrument and control equipment. In the specific system described herein the transmitting equipment comprises a keyboard perforator for perforating paper tape with the signals to be transmitted and a device for transmitting said message in accordance with perforations on the tape. For example, at station 216 the receiving instrument and keyboard perforator are illustrated diagrammatically and designated 225 in Fig. 2. The transmitting distributor is designated 235, while control equipment is designated 236. Similar equipment is provided at the other stations. In addition station 219 is provided with a receiving recorder or perforator 229 for reperforating paper tape in acordance with messages received from the system. This reperforator is provided at those stations at which other telegraph lines or circuits terminate so that messages intended for these other stations connected to these other lines may be recorded at station 219 and then later automatically transmitted over the proper line without requiring the time of an operator or attendant to retransmit the message.

In order to transmit messages over the system, the attendant or subscriber at the outlying or way stations perforates the message on the paper tape for later transmission over the system. Preceding each message, an address code or group of switching signals is perforated in the tape and following each message an end-of-message or disconnect signal is perforated in the tape. Following the end-of-message signal, the subscriber can perforate any address signal followed by another message intended for the station designated by the address. Following this message and each of the messages, an operator will then perforate a disconnect signal. In addition, the operator or attendant will usually perforate an end-of-transmission signal in the tape after the disconnect signal following the last message available for transmission from the station.

The attendant or operator at the outlying station will then insert a tape in the transmitter for transmission over the system. At a later time, the transmitter is started to operate automatically or under control of the operator at the central switching station. Thereafter the message is transmitted to the central switching station and recorded thereat.

The circuits of the central switching station are illustrated in Figs. 3 and 4. Fig. 4 shows the originating position or station of the central switching station comprising a keyboard perforator 411, monitor receiving instrument 410, transmitter or transmitter-distributor 412, control relays 413 and a director circuit 414. Fig. 4 also shows a miscellaneous intercept circuit 427 and a receiving reperforator 426 and tape receptacle 425. A willful intercept circuit 424 is also shown. This intercepting circuit is provided with a repeating instrument 420 comprising a recorder or reperforator 421, transmitting device 422, and a director circuit 423. Fig. 4 also shows multiple outlet circuits in accord-

ance with the present invention. In the illustration in Fig. 4, three channels of transmission all included in the multiple outlet circuits **450**, **451**, **452** are provided. These channels extend to corresponding receiving teletypewriters **460**, **461** and **462**. Receiving teletypewriters **460**, **461** and **462** may be located at the central switching station or they may be located a short distance from the central switching system and connected thereto by means of transmission channels **470**, **471** and **472**.

Each of the party lines terminating at the switching office or central switching station is provided with an incoming line circuit **322**, a receiving only circuit **323**, storage repeater **324**, and the associated transmitter **325**. The incoming line circuit **323** causes the messages intended for the central station to be recorded on the receiving only instrument **323** and causes the messages intended for other stations to be recorded and reperforated by perforator **326**. Director circuit **327** is associated with transmitter **325** and serves to connect transmitter **325** selectively to any of the outgoing line circuits, the lines of which terminate in the central switching station, under control of address characters receiving each message.

Each of the party lines is also provided with a transmitter start circuit such as **318**, an outgoing line circuit and equipment for transmitting messages over party lines.

Briefly, messages directed to stations over party line **210** are transmitted to storage repeaters associated with line **210** under control of director circuits associated with the lines upon which the messages originate. The messages are later transmitted over line **210** one at a time.

The multiple outgoing line circuits cooperate with the director circuit in the same manner as the outgoing line circuits and cause the directors to transmit messages immediately to the receiving only machines located at the station of destination of the message instead of causing the message to be transmitted to storage equipment for later transmission over lines extending towards the station of the ultimate address.

Figs. 2 and 3 also show a trunk circuit **290** comprising two transmission channels **290** and **291** extending to a distant central switching station **295**. Terminal equipment associated with this trunk circuit is substantally the same as that associated with each of the party lines and described above, except that no transmitter start circuits are provided for the trunk circuits.

Operation of the various circuits referred to above, except the multiple outlet circuits, is described in detail in the above-identified copending patent application, Branson et al., which application is hereby made a part of the present application as it is fully included herein. Inasmuch as the respective circuits, referred to above, forming parts of the system disclosed herein operate in substantially the same manner as described in said identified application of Branson et al., repetition of a more detailed description thereof is not justified.

Turning now to the detailed showing in Figs. 5, 6, 7 and 8 when arranged as shown in Fig 1*b*, it will be noted that Fig. 5 shows in outline form certain portions of the director circuit together with a representation of another director circuit, a sequence circuit, and an intercept circuit. Fig. 6 shows the connections to the cross bar switch associated with two director circuits. Fig. 7 shows the multiple outlet circuit arranged with three recorders or outlets while Fig. 8 shows the connections of said circuits with the cross bar switch.

It will be readily understood by persons skilled in the art that Fig. 7, together with the connections to the cross bar switch as shown in Fig. 8, may be readily added to the system disclosed in the above-identified patent application of Branson et al., by merely adding these two figures either above or below the figures already in said application or between any of the horizontal rows of figures of said application providing the necessary leads are added to and carried across the respective figure as required. Such an addition may be made without any change in the disclosure of said Branson et al., application and without any other alteration of any of the circuits disclosed therein whereupon the circuits of said application will operate as described therein and cooperate with the circuits described herein and the circuits disclosed herein will operate as will be described.

In the exemplary embodiment of the invention disclosed in Fig. 7, three printers **725**, **745** and **765** comprise three outlets of a multiple outlet circuit. It will be readily understood that any suitable number of such outlets may be provided as are required by various traffic and other considerations. In the usual installation all of the outlets of any given multiple outlet circuit will be located at the same place and usually in the same room adjacent one another. This location may be in the same building or even the same room as the central switching equipment. However, this location will usually be at some short distance from the central switching center and connected thereto by means of individual trunk circuits.

While in the usual installation all of the recording devices associated with the multiple outlet circuit will be located at the same place and in the same room, it is not necessary that they be so located. For example, one or more of the outlets may be located at some distance from the other outlets and arranged for night service or for service at any other specified interval by appropriate operation of make-busy keys as will be described hereinafter.

Furthermore, the circuit connections to the outlets will usually be all the same for a given multiple outlet circuit. However, such arrangement is not necessary and as shown in Fig. 7, three different modifications of the circuits extending from the central switching center to the receiving instruments have been shown for purposes of illustration.

The receiving device **725** may be any suitable type printer or reperforator or other receiving instrument. In the exemplary embodiment of the invention described herein it is assumed to be a printer of the type disclosed in United States Patent 1,745,633, granted to S. Morton et al., February 4, 1930, or 1,904,164, granted to S. Morton et al., April 18, 1933, the disclosure of which patents are hereby made part of the application as if fully included herein. As shown in Fig. 7, printer **725** is connected to the central switching station by means of a loop or transmission path **701**. Loop **701** extends to a repeating relay **724** at the central switching center. Thus, the arrangement shown in Fig. 7 is more suitable for the longer loops.

The printer **765** is shown connected to the central switching station, also by a single loop **704**. In this case the loop is not shown provided with a

repeating relay. Consequently, the transmission circuits which cooperate with receiving equipment **765** as shown in Fig. 7 is more suitable for loop circuits of intermediate length, that is, loop circuits somewhat shorter than suitable for operation as shown by loop **701**.

Recording instrument **745** is shown connected to the central switching equipment by means of two loops **702** and **703**. The loop circuit **703** comprises the transmission circuit for the transmission of telegraph signals, while the loop **702** is provided for certain control functions which will be described hereinafter.

It will be readily understood by persons skilled in the art that repeaters may be connected in loop **704** and also in **703** and **702** if it is so desired. However, where the distances are short, repeaters will not be employed in these loops as a general rule.

Make-busy keys **727**, **747** and **767** are provided for the respective instruments **725**, **745** and **765**. The make-busy keys will be normally operated to positions shown in the drawings when it is desired to receive messages on the associated receivers. However, when it is desired to cause all the messages to be directed to the other printers of the multiple outlet circuit, the make-busy keys associated with the printers not to receive messages will be operated to the position opposite to the positions shown in the drawings. When these keys are so operated, they will cause the messages to be directed to other printers of the multiple outlet circuit or to the intercept circuit **503** if the overflow key **770** is operated as will be described hereinafter.

Receiving instrument **745** is provided with an additional set of contacts **749** which operate once for each character or code combination received by the printer **745**. Contact **749** is employed for control purposes as will be described hereinafter.

Assume for purposes of illustration that a message addressed to the multiple outlet station at which printers **725**, **745** and **765** are located arrives at the transmitting point of the transmitter **528** associated with director **501**.

As set forth in detail in the above-identified application of Branson et al. when the first code of the address arrives over the sensing pins of the transmitter and is sensed it causes the first fan relays **520** of director **501** to be positioned in accordance with this code combination. The first fan relays **520** have been represented symbolically by box **520** in which one relay is shown. Persons skilled in the art however will readily understand that the first fan relays comprise a group of relays which are positioned in accordance with the elements of the first code of the address codes.

Upon the setting of the first fan relays **520** in accordance with the first address code one of the code relays **524**, **525**, **526**, etc., will be operated. Assume for purposes of illustration that relay **525** will operate. Upon completion of the circuit through the winding of relay **524** the operation of relays due to current flowing in this circuit of the director will cause the succeeding address code stored in the tape of the associated transmitter to be scanned. In addition, relay **523** will operate and transfer the control circuits from the first group of fan relays **520** to a second group of fan relays **521**. Thereafter the relays of this second group of fan relays will be positioned in accordance with the second address code stored in the tape. As in the case of the first group of fan relays the second group of fan relays will generally comprise a group of relays each of which is positioned in accordance with certain elements of the code employed. While only one relay is shown within box **521**, persons skilled in the art will readily understand this symbolic representation of a group of relays which may be positioned in accordance with a code combination.

Upon the operation of the first and second fan relays a code point **550** is selected in a circuit extending from conductor **550** through the contacts of relay **524** and the second group of fan relays **521** to the test and control circuits **522** of director **501** through the operated contacts of relay **523**.

Code point **550** is connected through a cross-connection **551** to an intercept key **552**. Assume for purposes of illustration that the intercept key **552** is in its normal position as shown in the drawings. Under these circumstances the circuit from code point **550** then extends through the break contacts of key **552** and over conductor **511** to contacts of relay **711** of the multiple outlet circuit. Assume first that none of the channels of the multiple outlet circuit are busy. Consequently, relay **711** will be released so that conductor **511** then extends through the back contacts of relay **711** and the right-hand break contacts of relay **714** over conductor **813** to battery through the winding of hold magnet **847** of the cross bar switch.

When the multiple outlet circuits are idle, as shown in the drawings, battery will be connected to conductor **511**. However, when these paths are busy, as will be described hereinafter, ground is connected to conductor **511**. The test and control circuits **522** first test this lead for a busy condition and if the circuit is idle, as assumed, the test and control circuits are advanced.

Next the test and control circuit **522** in cooperation with the sequence circuit **504** will cause the operation of the selector magnet **601**. The operation of the selector magnet will then again cause the test and control circuits to advance and again test lead **511**, this time for the polarity of the potential connected thereto and also for the impedance connected between this lead and the source of potential connected thereto. If only a single hold magnet is connected to lead **511**, the test and control circuits **522** as well as other circuits of the director are advanced and cause direct ground to be connected to lead **511**.

The application of ground to lead **511** completes a circuit for the operation of the hold magnet **847**. The operation of magnet **847** at the time the selector magnet **601** of the cross bar switch is operated causes the contacts at the cross-point to be operated and extend a plurality of circuits or leads between the first channel and the multiple outlet circuit shown in Fig. 7 and the director **501**.

The operation of the hold magnet **847** in addition completes a circuit for the operation of relay **713** from ground through the operated contacts of hold magnet **847** over lead **815** and the left-hand break contacts of relay **714** to battery through the winding of relay **713**.

The operation of relay **713** connects ground to lead **816** which extends through the operated cross bar contacts to lead **616** and thence through the winding of relay **532** to battery. The dotted line indicates other switching contacts. Relay **532** of the control relays and circuits of director **501** then causes the director circuits to advance which, in turn, releases a sequence circuit **504** and the selector magnet **601**. The release of selector magnet **601**, however, does not cause the operated

contacts at the cross-point of the cross bar switch to release. Instead, these contacts are maintained closed so long as the hold magnet 847 remains operated.

The operation of relay 532 causes the director relays and control equipment to advance and apply ground to conductor 614 through the marginal relay 529 thereby completing a circuit through the cross-point contacts and over lead 814 for the operation of relay 714. Relay 714 in operating completes a circuit for maintaining the hold magnet 847 operated and transfers the holding circuit of relay 713 from conductor 815 to conductor 511. Upon the further advance of the director circuit ground will be removed from conductor 511 and permit relay 713 to release. The release of relay 713 completes a circuit for the operation of relay 712 through the left-hand break contacts of relay 713 and over conductor 816 and the cross bar contacts of lead 616 and operated contacts of relay 532 to ground over lead 617 and the operated cross bar contact.

Relay 712 in operating completes an obvious circuit for the operation of relay 711. Relay 711 in operating completes a circuit for maintaining itself operated over lead 815 under control of the hold magnet 847. Relay 711 in operating also causes busy lamp 722 to light to indicate to the attendant at the central switching point that the first channel of the multiple outlet circuit is busy. Relay 711 in operating also transfers lead 511 from the contacts of relay 714 to the contacts of relay 731 and relay 734 thus conditioning the second channel of the multiple outlet circuit for the reception of another message should one be directed to this station during the time the first channel is busy.

Operation of relay 712 as described above also connects ground to lead 811 which extends through the operated cross bar contacts and over conductor 611 to the winding of relay 531 and under certain circumstances to the winding of relay 530. Relay 531 of the director circuit 501 operates at this time and causes the director circuit to advance and first transmit the address characters which preceded the message to station or printing equipment 725 and thereafter the message.

As described in detail in the above-identified application of Branson et al., the entire address is transmitted over conductor 612 preceding the message while only the latter portion of the address is transmitted over lead 610 preceding the message. As shown in the drawings, the transmission path 812 which extends through the upper winding of the repeating relay 724 is connected through the operated cross bar contacts to conductor 612. Consequently as shown in the drawings, the entire address will be transmitted to the receiving equipment 725 preceding each message. As will be readily understood by persons skilled in the art, if it is desired to transmit only a portion of the address to the receiving equipment 725 the transmission conductor will be arranged to extend from the upper winding of the repeating relay 724 and through the cross bar switch contacts to lead 610. Both arrangements are described in greater detail in the above-identified Branson et al. application forming a part of the present application.

As indicated above, signals are transmitted from the transmitter 528 associated with director 501 over conductor 612 through the operated cross bar contacts and conductor 812 to the upper winding of repeating relay 724. Relay 724 repeats the signals over conductor 701 to the selector magnet 726 of the receiving instrument 725. Receiving instrument 725 will then record the message.

Relay 729 follows the signals and repeats them to the busy lamp 721 which lamp flashes during the transmission of signals over conductor 701 thus indicating to the attendant that the signals are being repeated over this conductor. Relay 729 is connected in series with loop 701. Relay 729, however, is a differential relay having its winding so connected that during normal operation of the system the same current flows through each winding of the relay in such a direction as to neutralize the effect of current flowing through the other winding of this relay. Consequently, relay 729 does not respond to the transmission of any signals over the loop 701. Relay 729 does not operate during idle periods during which relay 724 is maintained on its marking contact as shown in the drawings because the same current flows through both windings of relay 729.

If, however, the attendant for any reason wishes to interrupt the transmission of messages over the system the attendant may operate the busy key 727. Operation of the busy key connects ground to the upper conductor of loop 701 and interrupts the current flowing over the lower conductor of this loop thus unbalancing relay 729. At this time no current will flow through the left-hand winding of relay 729 but current will flow through the right-hand winding of relay 729 and cause relay 729 to operate and complete an obvious circuit for the operation of relay 723.

Operation of relay 723 during the time a message is being transmitted to the recording device 725 completes a circuit for the operation of relay 715. The operation of relay 723 also interrupts the operating or holding circuit of relay 716 which previously extended through the back contacts of relay 723. A short interval of time later relay 716 will release and complete a circuit for the operation of relay 717. Relay 717 operates and completes a circuit for the operation of the trouble lamp 719 and in addition connects ground to the alarm circuit lead 790.

The operation of relay 717 also short-circuits resistance 728 which is connected in series with conductor 814 extending through the operated cross bar contacts and lead 614 and the winding of the marginal relay 529 to ground. Upon the short-circuiting of resistance 728 marginal relay 529 will operate and stop the operation of transmitter 528 in the manner described in the above-identified Branson application and also indicate to the attendant at the central switching station the transmitter from which the message is being transmitted to recorder 725 at the time key 727 is operated.

After the attendant at the central switching center has determined the source of trouble or service requested by the outlying subscriber the circuits may be restored and transmission resumed as described in the above-identified patent application of Branson et al. which forms a part of the present specification.

At the end of the message the director circuit 501 will respond to the end-of-message signal by advancing and interrupting the circuit of relay 712 extending over lead 816, the operated cross bar switch contacts and lead 616 to ground. In responding to the end-of-message signal the director circuit removes ground from this lead and permits relay 712 to release. Relay 712 in releasing connects ground to the transmission lead 812 and thus maintains repeating relay 724

in its marking position so that it is unable to send any further signals over lines 701 to the receiving instrument 725.

Relay 712 in releasing also removes ground from lead 811 extending to the director circuit. The director circuit is advanced in response to the removal of ground from lead 811 and 611 and in turn removes ground from lead 814 thus interrupting the operating circuit of relay 714. The release of relay 714 removes ground from the winding of hold magnet 847. The hold magnet 847 will then release and cause the cross bar switch contacts at the cross-point to open. The release of the hold magnet 847 interrupts the locking circuit of busy relay 711 thus permitting this relay to release and connect lead 511 to the winding of the hold magnet 847.

The release of magnet 847, the release of the cross bar switch contacts, as well as the release of relays 711, 712 and 713, restore the first channel of the multiple outlet circuit to its normal or idle condition. When the next message is directed to the multiple outlet circuits by the particular code combination assigned to these stations, circuits will function as described above and cause the message to be transmitted to the receiving machine 725.

The attendant or subscriber may operate the station busy key 727 associated with the recording device 725 at a time during which no signals are being recorded or received thereby. When key 727 is operated at these times relay 729 will operate, as described above, and complete a circuit for the operation of relay 723. The operation of relay 723 at this time completes a circuit for the operation of relay 711 from battery through the left-hand winding of relay 711, the right-hand outer break contacts of relay 712 to ground through the operated contacts of relay 723. Relay 711 in operating transfers lead 511 from the winding of hold magnet 847 to the winding of hold magnet 848.

It is also possible for the attendant at the central switching station to make the first channel of the multiple outlet circuit busy by operating busy key 718. The operation of this key again completes a circuit for the operation of relay 711 from battery through the left-hand winding of relay 711 to ground through the right-hand operated contacts of key 718. As long as key 718 or 727 remains operated relay 711 will remain operated and prevent messages from being transmitted to recording instrument 725.

Assume now for purposes of illustration that during the time relay 711 is operated either due to the fact that messages are being transmitted to the recording instrument 725 or due to the operation of key 727 or due to the operation of key 718 a message is directed to the multiple outlet circuits. That is, it is preceded by an address code which designates the multiple outlet circuits or station. In this case the lead 511 will extend through the operated contacts of relay 711 and the break contacts of relay 731 to battery through the winding of magnet 848 and the right-hand break contacts of relay 734. Consequently, when the message addressed to the multiple outlet station arrives at the transmitting point of the transmitter 528 of director 501 or at the corresponding point of any of the other directors the busy condition of the second channel will be tested and magnet 848 operated during the time the selector magnet 601 of cross bar switch is operated. Thereafter the message will be directed to the receiving instrument 746 in the same manner as described above with reference to the transmission of messages to the receiving instrument 725.

As indicated above, the modification of the circuit shown extending to recorder 745 is more adapted for the shorter loops. In this modification transmission is directed from transmitter 528 over the conductors 703. Relay 740 follows the signals transmitted and causes lamp 741 to flash at this time. The second pair of wires 702 extends to the recording instrument 745. In addition to the make-busy key 747 associated with the recorder 745 a universal contact 749 is provided. These contacts are arranged to be operated once for each code combination received by the recording device 745. In the modification shown extending to the recorder 745 the operation of relay 732, which corresponds to the operation of relay 712 described above, interrupts the operating circuit of relay 736. Relay 736, however, is a slow-release relay and requires an appreciable time before it releases and closes its contacts. Operation of relay 732 also extends a circuit from battery through the winding of relay 735 and the right-hand outer operated contacts of relay 732 to the right-hand contact of universal contacts 749. As described in the above-identified application of Branson et al. a short interval of time after relay 732 operates the circuits of the director will normally advance and cause the transmission of signals over conductor 612 and thence over conductor 832 through the operated cross bar switch contacts. These signals will then be transmitted to the selector magnet 746 of the recorder 745 and cause the universal contact 749 to operate. During the normal operation of the system the universal contact 749 will be operated before relay 736 releases. The operation of these contacts completes a circuit for the operation of relay 735 and relay 735 in operating completes a circuit for maintaining itself operated from battery through its winding, the right-hand outer operated contacts of relay 732 to ground through the left-hand operated contacts of relay 735.

The operation of relay 735 then extends a circuit from the winding of relay 736 to the left-hand contacts of universal contacts 749. Consequently, when the universal contacts 749 are restored to their normal position at the end of each code combination a circuit will be completed through the winding of relay 736 thus tending to maintain relay 736 operated. Relay 736 is sufficiently slow in releasing so that it will be maintained operated by the closure of the left-hand contacts of the universal contacts during the transmission of signals to the recording device 745. Consequently, transmission will proceed in the normal manner.

However, if for any reason the director circuit does not transmit signals to the recording instrument 745 or the recording instrument does not respond to signals transmitted to it and cause the operation of universal contacts as described above before the release of relay 736, relay 736 will release and complete a circuit for the operation of relay 737 from battery through the winding of relay 737 and break contacts of relay 736 to ground through the right-hand inner operated contacts of relay 732. The operation of relay 737 completes a circuit for lighting the trouble lamp 739 and also connects ground to the lead extending to the alarm circuit. In addition, the operation of relay 737 short-circuits resistance 748

connected in series with lead 614 extending to the director circuit and causes the operation of relay 529 of the director circuit which, as described above and also in the above-identified application of Branson et al., causes the director circuit to stop and light trouble lamps whereupon the trouble may be corrected by the attendant and the message transmitted to the proper station.

The operation of the busy key 747 during the time the message is being transmitted to the recording instrument 745 produces no effect until after the transmission is completed. However, after the message has been fully received and the circuit returned to its normal condition or if the busy key is operated during the time the recorder 745 is idle a circuit will be completed for the operation of relay 731 from battery through the left-hand winding of relay 731 and the right-hand outer break contacts of relay 732 to ground through the operated contacts of the make-busy key 747. Relay 731 will thus be maintained operated as long as the busy key 747 is operated. The operation of relay 731 in turn transfers the selecting lead extending from the intercept key 552 to the break contacts of relay 751 associated with the third channel of the multiple outlet circuit. Hence, no message will be directed to the recording instrument 745 as long as key 747 is operated.

The attendant at the central switching station may operate the busy key 738 which will cause the operation of relay 731 and thus prevent any messages from being directed to the recording instrument 745.

If both the recording instruments 725 and 745 are busy receiving messages or one or both of the make-busy keys associated with them have been operated and another message is directed to the multiple outlet circuit lead 511 extends through the operated contacts of relays 711 and 731 through the break contacts of relays 751 and 754 to battery through the winding of the hold magnet 849. Consequently, this message will be directed over the third channel 704 to the recording instrument 765. The features of the invention incorporated in the circuits of the third channel operate in substantially the same manner as those described above with reference to the first channel excepting that no repeating relay is shown connected from the transmission channel 704 extending to the recorder 765.

If all of the recorders 725, 745 and 765 are busy relays 711, 731 and 751 will likewise be operated. At this time lead 511 will extend through the operated contacts of these relays to ground through the break contacts of the overflow key 770. Under these circumstances the director circuits, with the messages directed to the multiple outlet circuit in the transmitting and selecting positions, will wait until one or the other of the channels becomes idle at which time that channel will be seized and the message transmitted to the associated recording instrument. During the times of overload it may be sometimes desirable to provide an additional channel to receive certain messages directed to the multiple outlet circuit. If it is desired the overflow key 770 may be operated at these times and extend lead 511 through the operated contacts of relays 711, 731 and 751 to lead 510 extending to the intercept circuit 503. Then if a message is directed to the multiple outlet circuit during the time all three of the recorders associated therewith are busy the succeeding message will be directed to the intercept circuit 503 where it may be later transmitted to one of the recorders associated with the multiple outlet circuit.

Of course if it is desired to take the multiple outlet circuit completely out of service it is possible to operate the intercept key 552 and thus transfer all of the messages preceded by an address code designating the multiple outlet circuit to the intercept circuit.

It will also be apparent to those skilled in the art that during nights and on Sundays and holidays busy keys of one or more of the multiple outlet recorders may be operated or the busy keys at the central stations associated with the respective channels may be operated whereupon all of the messages preceded by the address code designating the multiple outlet circuit or station will be automatically directed to that machine or those machines which do not have the busy key operated. In this manner it is possible to have a machine set aside at a remote location for receiving urgent messages outside of business hours. Conversely, during business hours the busy key at the night station may be operated so that all the messages will be directed to the machines at the location most suitable during business hours. It is of course possible to have machines at more than two locations when desirable.

What is claimed is:

1. In a telegraph system, a switching station, means at said station for selectively directing messages to telegraph lines in accordance with address signals preceding each message, a plurality of receiving printers, a telegraph channel individual to each of said printers extending from said switching station, apparatus including said switching apparatus for selecting any of said channels to individual printers which are idle in response to a common address code and apparatus adjacent each of said printers for conditioning said switching equipment to prevent the selection of the respective printer.

2. In a telegraph switching system in which messages are automatically directed to transmission channels in accordance with address codes preceding the messages, a plurality of transmission channels assigned a common address code, switching apparatus for directing messages to said channels individually in response to said common code and apparatus operative incident to the busy condition of one or more of said plurality of channels for preassigning in a predetermined and preferential order others of said channels to which succeeding messages are individually directed.

3. In a telegraph switching system in which messages are automatically directed to receiving printers in accordance with address codes preceding the messages, a plurality of receiving printers assigned a common address code, switching apparatus for directing messages to said printers individually in response to said common code, apparatus controlled by the busy condition of the individual printers of said plurality of printers for determining the printer to which said messages are individually directed, and manually controlled means individual to at least certain of said printers for preventing the direction of messages thereto by said switching equipment.

4. In a telegraph transmission system, a plurality of telegraph transmitting and receiving devices, switching apparatus responsive to directing codes preceding messages for selectively directing the associated message to said receiving devices, said switching apparatus including

means for directing messages preceded by predetermined directing signals to any one of a group of receiving devices, and apparatus controlled by the busy condition of the individual devices of said group for preassigning one at a time and in a preferential order the receiving devices of said group to which the next message will be directed.

5. In a telegraph transmission system, a plurality of telegraph transmitting and receiving devices, switching apparatus responsive to directing codes preceding messages for selectively directing the associated message to said receiving devices, said switching apparatus including means for directing messages preceded by predetermined directing signals to any one of a group of receiving devices, apparatus controlled by the busy condition of the individual devices of said group for determining the particular one of said receiving devices of said group to which any given message is directed, and a manually controlled switching means adjacent one or more of the receiving devices of said group for preventing the transmission of messages thereto by said switching apparatus.

6. In a telegraph transmission system, a plurality of telegraph transmitting and receiving devices, switching apparatus responsive to directing codes preceding messages for selectively directing the associated message to said receiving devices, said switching apparatus including means for directing messages preceded by predetermined directing signals to any one of a group of receiving devices, apparatus controlled by the busy condition of the individual devices of said group for determining the particular one of said receiving devices of said group to which any given message is directed, and manually controlled switching apparatus adjacent one or more of said receiving devices for making the associated receiving device test busy and to cause the transmission of messages to other receiving devices of said group.

7. In a telegraph system, a plurality of receiving devices assigned a common address of a plurality of codes, switching apparatus responsive to address codes preceding messages for automatically and selectively directing the associated message to receiving devices assigned the respective address codes, a single lead associated with said plurality of receiving devices assigned said common address code, means included in said switching apparatus for selecting said common lead in response to said common address code, apparatus controlled by the busy conditions of said plurality of receiving devices assigned a common address code for automatically associating said lead with an idle one of said receiving devices, and means for initiating the connection of said idle receiving device to said switching apparatus over said single lead.

8. In a telegraph system, a plurality of receiving devices assigned a common address of a plurality of codes, switching apparatus responsive to address codes preceding messages for automatically and selectively directing the associated message to receiving devices assigned the respective address codes, a single lead associated with said plurality of receiving devices assigned said common address code, means included in said switching apparatus for selecting said common lead in response to said common address code, apparatus controlled by the busy condition of a respective receiving device of said plurality of receiving devices assigned a common address code for automatically associating said lead with an idle one of said receiving devices.

9. In a telegraph system, a plurality of receiving devices assigned a common address code, switching apparatus responsive to address codes preceding messages for automatically and selectively directing the associated message to receiving devices assigned the respective address codes, a single lead associated with said plurality of receiving devices assigned said common address code, means included in said switching apparatus for selecting said common lead in response to said common address code, apparatus controlled by the busy condition of a respective receiving device of said plurality of receiving devices assigned a common address code for automatically associating said lead with idle ones of said receiving devices one at a time in a predetermined order, and means for initiating the connection of said idle receiving device to said switching apparatus over said single lead.

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