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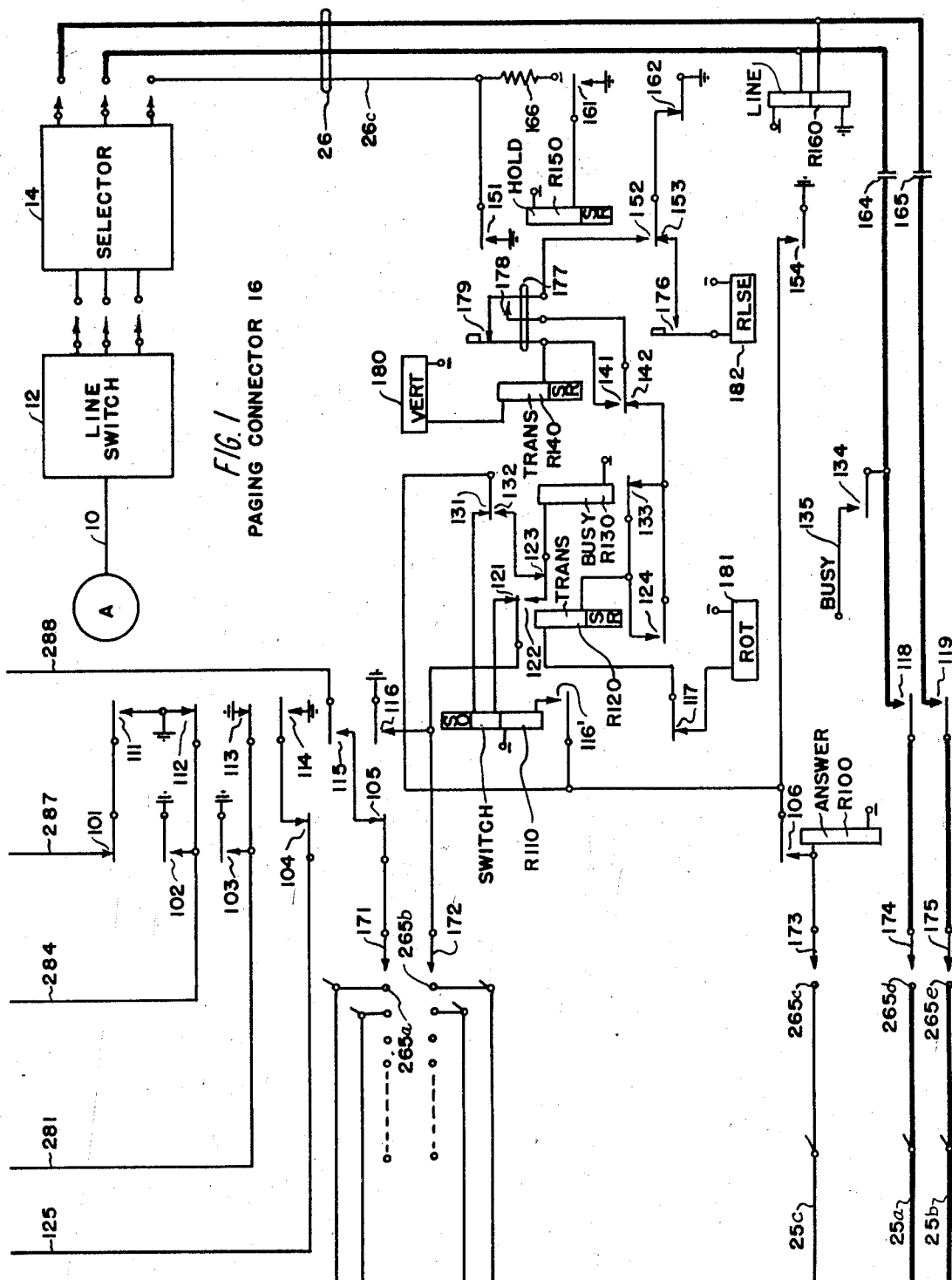
C. E. LOMAX

2,335,524

SIGNALING SYSTEM

Filed April 26, 1941

3 Sheets-Sheet 1.



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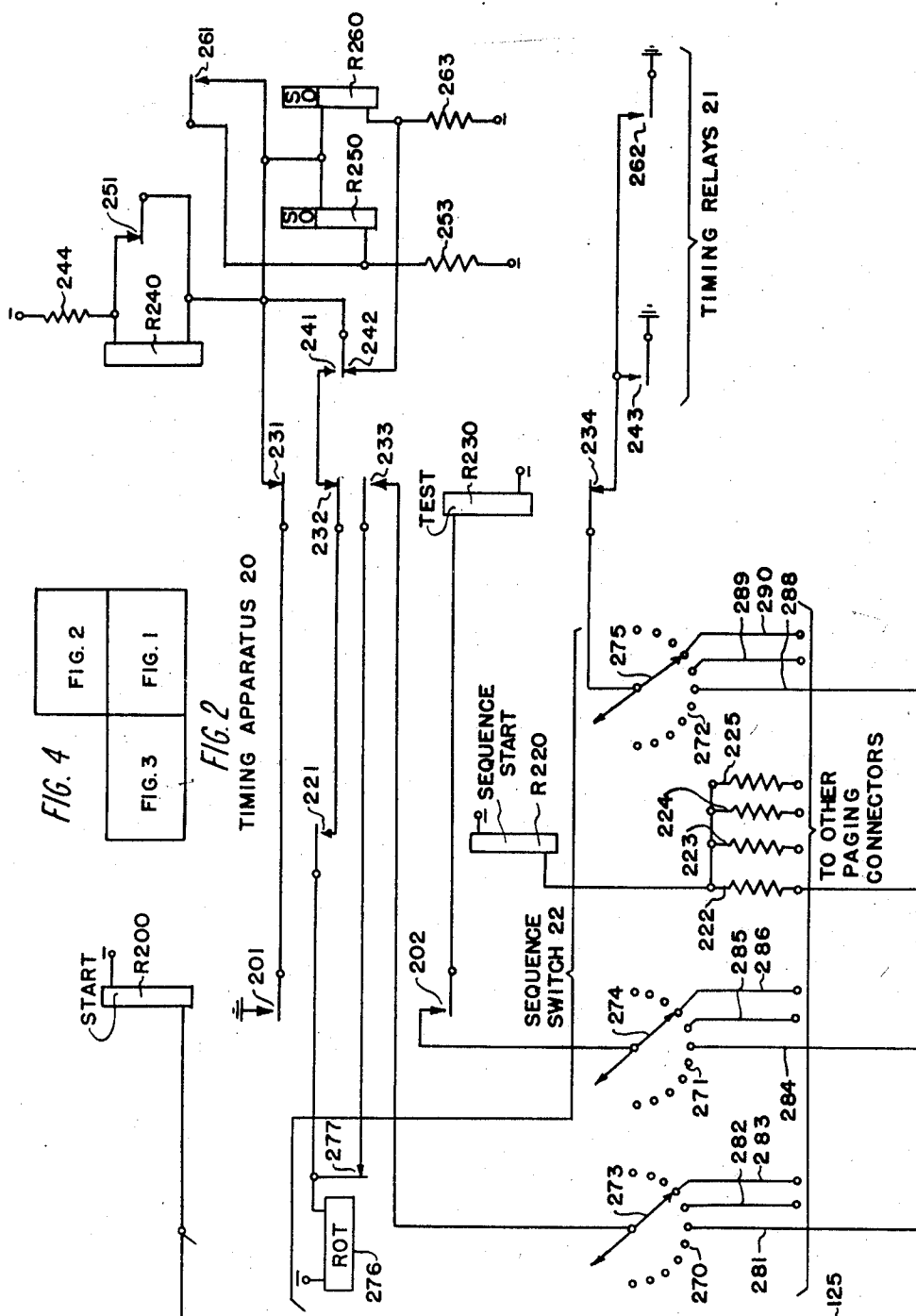
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2,335,524

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3 Sheets-Sheet 2



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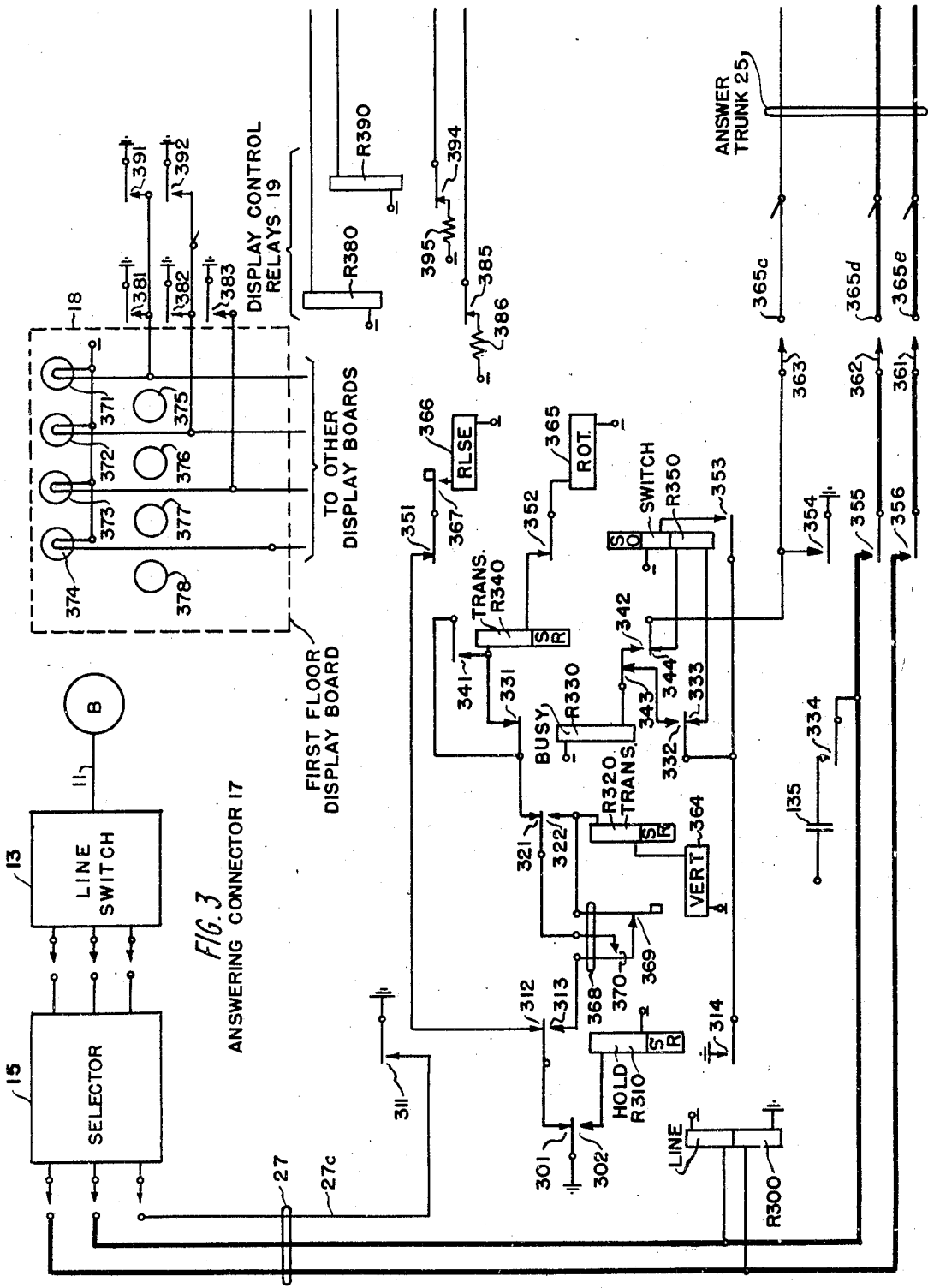
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,335,524

SIGNALING SYSTEM

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Application April 26, 1941, Serial No. 390,595

17 Claims. (Cl. 179—18)

The present invention relates to improvements in combined communicating and paging systems and has for one of its objects the provision of an improved signaling system in which the regular branch telephone exchange facilities of a hospital, for example, may be used in conjunction with improved paging equipment to provide a vehicle whereby any person attached to the hospital staff may be quickly summoned from any point in the hospital, and any person called over the paging facilities may quickly and easily acknowledge a call without the intervention or assistance of an operator.

It is another object of the invention to provide a system of the character described which is simple in arrangement, is positive and reliable in its operation to display indications designating a large number of persons, and may easily be controlled to display a paging indication on the display board of the system or to answer an indication which is set up on the display board.

It is a further object of the invention to provide a system of the character described wherein the regular automatic switching equipment of the branch exchange is utilized in setting up indications for display by the indicators of the display boards.

It is a further object of the invention to provide a system of the character described, wherein the indications designating a plurality of different persons who are being concurrently paged over the system are sequentially displayed by the display board indicators.

According to another object of the invention, each indication posted on the display board is automatically eliminated from the display sequence when a connection is set up through the telephone switching equipment for the purpose of answering the indication.

It is still another object of the invention to provide a system of the character described, wherein the sequential display of the different indications is arrested when the number of indications set up for display falls below a predetermined number.

It is still a further object of the invention to provide a system of the character described, wherein the automatic switches which are utilized for directly controlling the display indicators are also used in the answering connections which are set up incident to the answering of the indications posted on the display board.

In the illustrated embodiment of the invention, paging and answering connectors are provided which may be seized through the outlet contacts

of the selector switches conventionally included in the automatic switching equipment of the branch exchange. The paging connectors each have a plurality of different settings which individually correspond to different indications designating different persons who may be paged over the system, and each thereof may be selectively operated to the setting corresponding to any desired person, through operation of the calling or signal transmitting device conventionally provided at each of the branch exchange telephone substations. Display boards are provided on each floor of the hospital, and each display board is equipped with indicators in the form of signal lamps. These lamps, when energized in different combinations, produce different indications, each of which designates a particular person. The signal lamps are selectively controlled in accordance with the settings of operated ones of the paging connectors. More specifically, a display sequence switch is provided which is controlled from the paging connectors and functions to cause the indications set up in these connectors sequentially to be displayed by the display board indicator lamp. This sequence switch only operates when more than one indication is set up for display. If a single indication is set up in one of the paging connectors for display on the display boards, it is continuously displayed.

As indicated above, the paging connectors are also utilized to establish answering connections over which a person being paged may communicate with the substantiation from which he is called. To this end, answer trunks are provided which connect the corresponding outlet contacts of all of the paging and answering connectors. By virtue of this arrangement, a called person may, by dialing a predetermined answer number, arbitrarily assigned to him and to him alone, route a connection through an idle one of the answering connectors to the answer trunk which has been seized by the paging connector through which his paging indication was set up on the display boards. Each paging connector is also equipped with apparatus for eliminating an indication set up therethrough from the display sequence exhibited by the display boards when a talking circuit is established therethrough.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the

accompanying drawings in which Figs. 1, 2 and 3, when combined in the manner illustrated in Fig. 4, illustrate a portion of the equipment provided in a system embodying the features of the invention briefly outlined above.

Referring now more particularly to the drawings, the system there illustrated comprises a plurality of display boards which are individual to the various floors of a hospital and each of which is conveniently located for easy observation from any point in the corridor of the floor where it is provided. One such display board is indicated at 18 as being provided on the first floor of the hospital. This display board comprises a plurality of indicator lamps 371 to 378, inclusive, which are divided into two rows of four each and are arranged, in the manner more fully described hereinafter, to be energized in different combinations for the purpose of displaying indications designating the different doctors who may be paged over the system. Preferably, the lamps of the different rows are of different color in order to facilitate the reading of the different indications. For example, the lamps of the upper row may be white while the lamps of the lower row may be red. It will be understood that additional rows of lamps may be provided if the number of different indications which the board is required to display is exceptionally large. The display boards provided on the other floors of the hospital are identical in arrangement with the display board 18 individual to the first floor. As indicated by the multiple conductors appearing at the base of the rectangle designating the display board 18, the corresponding lamps of the various display boards are arranged to be energized in parallel, so that identical indications are concurrently displayed by all of the boards. For the purpose of directly controlling the energization of these lamps, a set of display control relays 19 is provided. With the illustrated system arrangement, facilities are available for paging a maximum of one hundred doctors. If the entire capacity of the system is to be used, one hundred display control relays, each having differently wired contacts, are provided. For convenience in explaining the operation of the system, however, only two of these relays, R380 and R390, have been illustrated in the drawings.

In accordance with conventional practice, the hospital is equipped with branch exchange telephone facilities, which are illustrated as being of the automatic type. These facilities include the substation lines 10 and 11 which respectively extend to the substations A and B; line switches 12 and 13 individual to the lines 10 and 11; a plurality of selector switches of which the two switches 14 and 15 are schematically illustrated, and a plurality of groups of connector switches, not shown. The line switches are individual to the various substation lines of the hospital and each thereof has access to a portion or all of the selector switches. These line switches may be of any desired commercial type, although preferably are of the well-known rotary type. Similarly, the connector and selector switches of the branch exchange may be of any desired form, although preferably are of the well-known Strowger type.

The control of the various display boards may be effected from any one of the substations of the branch exchange system. To this end, a group of paging selectors or connectors is provided. These connectors are accessible to the selectors of the system and, in turn, have access

to the display control relays 19, through the outlet contacts thereof. One such paging connector 16 is illustrated in the drawings as being accessible to the selector 14 over a trunk 26. Briefly

described, this connector comprises a two-motion switching mechanism of the well-known Strowger type, which mechanism is equipped with five banks of contacts each including one hundred contact points. The contacts making up this contact field are divided into ten levels of ten each, and each of the five banks has associated therewith one of the five wipers 171 to 175, inclusive. For the purpose of elevating these wipers to a position opposite a desired contact level, and then rotating the same into engagement with a selected contact set of the selected level, vertical and rotary magnets 180 and 181 are included in the switching mechanism. The mechanism further comprises a release magnet 182 which, when energized, permits the wiper carriage structure to be returned to rotary and vertical normal; and two sets of off-normal springs 176 and 177 which are operated when the wiper carriage structure is moved to any vertical off-normal position. In order to control the various magnets of the Strowger switching mechanism, the line switching, and the display control relays 19, the paging connector 16 is equipped with a plurality of control relays which include a line relay R160, a slow-to-release hold relay R150, a slow-to-release transfer relay R140, a busy test relay R130, a slow-to-release transfer relay R120, a slow-to-operate switching relay R110, and an answer relay R100. These relays are connected and arranged to operate in the manner more fully explained hereinafter.

As previously indicated, the arrangement of the system is such that when the paging connector 16, for example, is directed to a particular setting to set up a corresponding paging indication for display on the display boards, an answer circuit is partially established. This answer circuit may be utilized in establishing a communication connection between the paged doctor and the person who is paging this doctor. To this end, a group of answering selectors or connectors is provided. These connectors are also accessible to the selectors of the branch exchange switching equipment and, in turn, have access to a group of answer trunks. One such answering connector 17 is illustrated in the drawings as being accessible to the selector 15 over the trunk 27 and as having access to the answer trunk 25. The various answer trunks are multipled between the corresponding contact sets of the several answering and paging connectors. Thus the answer trunk 25 is illustrated as extending between the corresponding contact sets of the paging connector 16 and the answering connector 17, and as being multipled to the corresponding contact sets of each of the other answering and paging connectors.

Briefly described, the answering connector 17 comprises a two-motion switching mechanism of the well-known Strowger type, which is equipped with three banks of contacts each including one hundred contact points. The contacts making up this contact field are also divided into ten levels of ten each, and each of the three banks has associated therewith one of the three wipers 361 to 363, inclusive. Vertical and rotary magnets 364 and 365 are provided for elevating these wipers to a position opposite a desired contact level and then rotating the wipers into engagement with a selected contact set of the selected level.

The mechanism further comprises a release magnet 366, which when energized permits the wiper carriage structure to be returned to rotary and vertical normal; and two sets of vertical off-normal springs 367 and 368 which are operated when the wiper carriage structure is moved to any vertical off-normal position. In order to control the various magnets of the Strowger switching mechanism and the switching of the incoming trunk conductors of the line wipers 361 and 362, a group of control relays is provided which includes a line relay R300, a slow-to-release hold relay R310, a slow-to-release transfer relay R320, a busy test relay R330, a slow-to-release transfer relay R340, and a slow-to-operate line switching relay R350. These relays are connected and arranged to operate in the manner more fully described hereinafter.

As indicated above, provisions are made in the paging facilities whereby the various indications set up through the paging connectors for display by the display boards are displayed in sequence. These facilities include the common equipment or timing apparatus 20. Briefly described, this apparatus comprises a common start relay R200, a sequence start relay R220, a test relay R230, a sequence switch 22, and a set of timing relays 21. The sequence switch 22 is of the well-known rotary type. More specifically, this switch comprises three sets of contacts 270, 271 and 272, each of which includes eleven contact points, wipers 273, 274 and 275 individual to the enumerated contact sets, and means comprising an operating magnet 276 for driving the wipers over the contacts of their respective associated contact sets. The operation of this switch is directly controlled by the set of timing relays 21 which comprises only three relays R240, R250 and R260, the last two of which are of the slow-to-operate type.

Current for energizing the indicating lamps and the lamp control relays, as well as the operating magnets and the relays of the paging and answering connectors, is supplied from a common direct current source, the positive terminal of which is connected to a common bus conductor and to ground. The opposite terminal of this source is connected to a common negative bus conductor which terminates the connections from the various relay, magnet and lamp terminals identified in the drawings by the negative polarity sign. For convenience in describing the circuits involved, the source of current, which may conventionally comprise the exchange battery of the private branch exchange, has not been shown.

In order to facilitate the description of the operation of the system, it may be pointed out that each doctor attached to the staff of the hospital is assigned a predetermined call number, which number, when dialed at any one of the telephone substations of the system, will result in the display of a paging indication individually designating the particular doctor, at all of the display boards. These paging numbers may, if desired, be listed in the branch exchange telephone directory provided at each of the substations located in the hospital. Each doctor attached to the hospital staff is also assigned a predetermined answer number, which number, when dialed at any one of the substations provided in the hospital, will result in the setting up of a connection which extends from the answering substation in use to the calling substation from which the paging indication was posted

on the display boards. The call and answer numbers assigned to a particular doctor differ only in the first digit thereof. For example, if the trunks extending to the paging connectors are terminated in the second level of bank contacts of each of the selector switches, while the trunks extending to the answering connectors are terminated in the third contact level of each of the selector switches, all call numbers will include a first digit "2" and all answer numbers will include a first digit "3". The remaining two digits of each of the call and answer numbers, in various numerical combinations, serve to distinguish the different doctors.

With the above brief preliminary explanation in mind, it may be assumed that the substation A is provided for the use of one of the executives of the hospital, and that this executive desires to confer with the doctor having the call number 265. It may also be assumed that the display control relay R380 is individual to this particular doctor. In order to set up for display the paging indication which designates the doctor No. 265, the executive removes the receiver provided at the substation A from its supporting hook or cradle and dials the three digits of the doctor's identification number. When the receiver provided at this substation is removed from its supporting hook or cradle a calling loop circuit is established by way of the line 10, which extends to the line switch 12. The line switch 12 now operates in a well-known manner to select an idle one of the selectors to which it has access. If the selector 14 is seized through the outlet contacts of the line switch 12, the calling loop circuit is extended to this selector and dial tone is returned over the loop to signal the calling executive that the dialing operation may be started. When the first digit "2" is dialed at the calling substation A, the wipers of the selector 14 are elevated to a position opposite the second level of bank contacts in the associated contact field, and are then automatically rotated to test in succession the trunks terminated in this contact level, until a trunk extending to an idle paging connector is found. Assuming that the paging connector 16 is the first idle connector available, the selector 14, upon positioning its wipers upon the outlet contacts terminating the conductors of the trunk 26, operates to extend the calling loop circuit through the windings of the line relay R160. This relay now operates and closes its contacts 161 to complete an obvious circuit for energizing the slow-to-release hold relay R150. At its contacts 162, the relay R160 opens a point in the operating circuit for the release magnet 182 and a point in the common portion of the circuits over which impulses are transmitted in succession to the vertical magnet 180 and the rotary magnet 181. The hold relay R150, in operating, closes its contacts 151 to short-circuit the exchange battery in series with the resistor 166, and thus impress ground potential upon the release conductor 26c of the trunk 26. When this conductor is connected to ground, holding circuits are provided for preventing the release of the selector 14 and the line switch 12, and the paging connector 16 is marked as busy in the bank contacts of the selectors to which it is accessible. In operating, the hold relay R150 also closes its contacts 152 to prepare a circuit for energizing the transfer relay R140 and the vertical magnet 180 in series. At its contacts 153, the relay R150 opens another point in the incomplete operating circuit for the release

magnet 182. At its contacts 154, the relay R/150 prepares operating and locking circuits for the relays R/100, R/110 and R/130. Following the operation of the relay R/150, the paging connector 16 is conditioned to respond to the second digit "6" of the call number 265 assigned to the doctor being paged.

When this digit is dialed at the calling substation A, the calling loop circuit is opened and closed six times, whereby six impulses are transmitted to the line relay R/160. This relay follows the impulses and functions to repeat the same to the transfer relay R/140 and the vertical magnet 180 over a circuit which initially extends from ground by way of the contacts 162, 152 and 179, the winding of R/140 and the winding of the magnet 180 to battery. Each time the relay R/160 restores it also opens its contacts 161 to interrupt the operating circuit for the hold relay R/150. Due to its slow-to-release characteristic, the hold relay remains operated during impulsing. The transfer relay R/140 operates when the above-traced circuit is initially completed and, due to its slow-to-release characteristic, remains operated until shortly after the second digit is ended. In operating, this relay opens its contacts 142 to prevent the impulses of the second digit from being repeated to the transfer relay R/120 and the rotary magnet 181. At its contacts 141, the relay R/140 prepares a circuit for bypassing the off-normal contacts 179 in the above-traced pulsing circuit. Each time a current pulse is transmitted to the vertical magnet 180 over this circuit it operates to elevate the associated wiper carriage structure one step, so that at the conclusion of the second digit the wipers 171 to 175, inclusive, are positioned opposite the sixth level of bank contacts in the associated contact field. Incident to the vertical movement of these wipers, the off-normal contacts 178 are closed and the off-normal contacts 179 are opened. Thus, the second to sixth current pulses are transmitted to the vertical magnet 180 over the above-mentioned by-pass circuit which may now be traced as extending from ground by way of the contacts 162, 152, 178 and 141, and the winding of the transfer relay R/140. Incident to the vertical movement of the wiper carriage structure, the off-normal springs 176 are also closed, further to prepare the incomplete operating circuit for the release magnet 182.

At the end of the second digit, and during the interdigit pause between this digit and the third digit, the line relay R/160 remains in its operated position to cause the deenergization and release of the transfer relay R/140. In releasing, the relay R/140 opens its contacts 141 to interrupt the circuit for transmitting current pulses through its winding and the winding of the vertical magnet 180 in series. At its contacts 142, the relay R/140 prepares the above-mentioned circuit for transmitting current pulses through the series-connected windings of the transfer relay R/120 and the rotary magnet 181. Following the release of the transfer relay R/140 the paging connector 16 is conditioned to respond to the five impulses of the third and last digit of the call number assigned to the doctor No. 265.

When the third digit is dialed at the calling substation A, the loop circuit extending there-through to the paging connector 16 is opened and closed five times, so that five impulses are transmitted to the line relay R/160. This relay functions to repeat the impulses to the transfer relay R/120 and the rotary magnet 181 over a cir-

cuit which may now be traced as extending from ground by way of the contacts 162, 152, 178, 142 and 133, the winding of R/120, the contacts 117 and the winding of the magnet 181 to battery. When initially energized over this circuit, the relay R/120 closes its contacts 124 to complete a path in shunt with the contacts 133, whereby the impulsing circuit is not opened incident to the operation of the busy test relay R/130 which may occur as the wipers 171 to 175 traverse the contacts of the selected level. At its contacts 121, the relay R/120 opens a point in the operating circuit for the switching relay R/110. At its contacts 122, the relay R/120 prepares the operating circuit for the busy test relay R/130. At its contacts 123, the relay R/120 opens a point in the locking circuit for the busy test relay. Due to its slow-to-release characteristic, the relay R/120 remains operated until shortly after the third digit is ended. Each time the magnet 181 is energized over the above-traced circuit, it operates to rotate the wipers 171 to 175, inclusive, one step, so that at the conclusion of the third digit these wipers are positioned to engage the associated fifth contacts 265 of the sixth level in the associated contact banks. Thus the control relay R/380, individual to the doctor having the identification number 265, is selected.

The operation of the control equipment embodied in the connector 16, which occurs after the third digit is dialed, depends upon whether the control relay R/380 has previously been selected through another of the paging connectors from another substation. Thus if the indication individual to the doctor assigned the identification number 265 has already been set up for display on the display boards, the relay R/380 will occupy its operated position. With this relay operated, the test contact 265b individual thereto is connected to ground. Accordingly, when the wipers of the paging connector 16 are positioned to engage the contacts 265, in the manner just explained, a circuit is immediately completed for energizing the busy test relay R/130. This circuit extends from the grounded contact 265b by way of the wiper 172, the contacts 122 and the winding of R/130 to battery. When thus energized, the relay R/130 opens its contacts 133 to interrupt the initially completed circuit for transmitting current pulses through the series-connected windings of the transfer relay R/120 and the rotary magnet 181. At its contacts 131, the relay R/130 opens a point in the operating circuit for the switching relay R/110. At its contacts 132, the relay R/130 prepares a locking circuit for itself. At its contacts 134, the relay R/130 completes a path for transmitting busy tone signaling current over the established loop circuit to the calling substation A. The path traversed by this current may partially be traced as extending from the ungrounded terminal of the busy tone generator, not shown, by way of the busy tone lead 135, the contacts 134, the condenser 164, the negative side of the loop extending to the calling substation A, the receiver provided at this substation, the positive side of the indicated loop circuit and the lower winding of the line relay R/160 to the grounded terminal of the busy tone generator. This current, as reproduced by the receiver provided at the calling substation A, serves to inform the calling executive that the doctor No. 265 is already being paged from another substation.

Shortly following the operation of the busy test relay R/130 to perform the functions just de-

scribed, the transfer relay R120 restores. In releasing, this relay opens its contacts 124 to interrupt the circuit for transmitting current pulses to the magnet 181. At its contacts 121, the relay R120 prepares the operating circuit for the switching relay R110. At its contacts 123, the relay R120 completes the prepared locking circuit for the busy test relay R130, this circuit extending from ground by way of the contacts 154, 132 and 123 and the winding of R130 to battery. After this locking circuit is completed, the relay R120 opens its contacts 122 to interrupt the operating circuit for the busy test relay as traced above. Following the release of the transfer relay R120, no further operation of the connector 16 occurs until the connection is released at the calling substation. The manner in which the operated switching equipment, comprising the line switch 12, the selector 14 and the connector 16, is released when the call is abandoned at the substation A is explained in detail hereinafter.

In the event the display control relay R380 occupies its restored position at the time it is selected through the paging connector 16, in the manner explained above, the winding of the busy test relay R130 is short-circuited over the above-traced test circuit and remains in its restored position. Accordingly, when the transfer relay R120 restores shortly following the end of the third digit, a circuit is completed for energizing the switching relay R110, this circuit extending from ground by way of the contacts 154 and 131, the upper winding of R110, the contacts 121, the test wiper 172 and its engaged contact 265b, the contacts 385 and the resistor 386 to battery. When energized over this circuit the relay R110 first closes its preliminary make contacts 116' to complete an obvious locking circuit for itself. After this locking circuit is completed, the relay R110 opens its contacts 117 further to interrupt the above-traced circuit for transmitting current pulses to the rotary magnet 181. At its contacts 118 and 119, the relay R110 prepares an answer circuit which extends through the line wipers 174 and 175 to the talking conductors 25a and 25b of the answer trunk 25. At its contacts 116, the relay R110 completes an obvious path for impressing ground potential upon the test contact 265b, thereby to mark the display control relay R380 as busy in the bank contacts of the other paging connectors. At its contacts 112 and 113, the relay R110 disconnects the marking leads 281 and 284 from ground, for a purpose to be described hereinafter. At its contacts 115, the relay R110 prepares the operating circuit for the selected display control relay R380.

In operating, the relay R110 also functions to initiate the operating of the timing apparatus 20, providing this apparatus is not already operating. Thus when this relay operates, it closes its contacts 114 to complete a circuit including the start lead 125 for energizing the start relay R200. At its contacts 111, the relay R110 completes one of the several circuits for energizing the sequence start relay R220, this circuit extending from ground by way of the contacts 111 and 101, the lead 287, the resistor 222 and the winding of the relay R220 to battery.

Assuming that the paging indication under consideration is the only indication which has been set up for display by the display boards, the start relay R200 is energized and operates when ground potential is applied to the start lead 125, in the manner described above. In operating, this relay closes its contacts 202 to prepare or com-

plete a circuit for energizing the test relay R230. At its contacts 201, the relay R200 prepares a circuit for initiating the operation of the timing relays 21. Assuming that the wipers of the sequence switch 22 occupy a position which corresponds to another of the paging connectors, the operating circuit for the test relay R230 is completed. Thus, under the circumstances assumed, all of the paging connectors, with the exception of the connector 16, are idle. Accordingly, all of the marking leads 282, 283, 285, 286, etc., with the exception of the leads 281 and 284 individual to the connector 16, are marked with ground potential. The leads 281 and 284, on the other hand, are disconnected from ground. Accordingly, if the wipers 273, 274 and 275 occupy positions such that the contacts terminating the marking leads 281 and 284 are engaged by the wipers 273 and 274, respectively, the operating circuit for the test relay R230 is not completed incident to the operation of the switching relay R110. On the other hand, if these wipers occupy the positions illustrated in the drawings, a circuit including the grounded marking lead 286, the wiper 274 and the contacts 202 is completed for energizing the test relay R230. In operating, the test relay R230 opens its contacts 231 to interrupt the prepared operating circuit for the timing relays 21. At its contacts 232, the relay R230 opens an incomplete circuit for transmitting current pulses to the magnet 276. At its contacts 233, the relay R230 completes an alternative circuit for energizing this magnet, this circuit extending by way of the grounded marking lead 283, the wiper 273, the contacts 233 and 277, and the winding of the magnet 276 to battery. When thus energized, the magnet 276 operates to condition the associated ratchet and pawl mechanism to advance the wipers 273, 274 and 275 one step. At its contacts 277, the magnet 276 opens its operating circuit. When the magnet 276 is thus deenergized, the ratchet and pawl mechanism controlled thereby functions to advance the wipers 273, 274 and 275 one step, wherein the contacts terminating the marking leads 282, 285 and 289 are respectively engaged thereby. Since the marking leads 282 and 285 are also connected to ground, the magnet 276 is again energized and deenergized to advance the wipers 273, 274 and 275 a second step. It will be understood that the stepping operation of the sequence switch 22 continues until the marking leads 281, 284 and 288, individual to the paging connector 16, are selected. These leads are marked for selection by the absence of ground potential upon the first two thereof. When the paging connector 16 is thus selected by the sequence switch 22, the test relay R230 is deenergized and restores. In releasing, this relay opens its contacts 233 to interrupt the operating circuit for the magnet 276, and closes its contacts 234 further to prepare the above-mentioned circuit for energizing the selected display control relay R380. At its contacts 232, the relay R230 reprepares the other of the operating circuits for the magnet 276. At its contacts 231, the relay R230 completes the start circuit for the timing relays 21.

When this start circuit is completed, the slow-to-operate timing relay R250 is energized in series with the resistor 253. After a short interval, the relay R250 opens its contacts 251 to interrupt the path normally short-circuiting the winding of the relay R240. When this path is opened, the relay R240 is energized in a circuit which includes the contacts 201 and 231, and the re-

sistor 244. In operating, the relay R240 closes its contacts 241 to prepare one of the operating circuits for the magnet 276, and opens its contacts 242 to interrupt the path normally short-circuiting the winding of the relay R260. The relay R260 is now energized in a circuit which includes the contacts 201 and 231, and the resistor 263. In operating, the relay R260 closes its contacts 261 to complete an obvious path for short-circuiting the winding of the relay R250. The latter relay now restores and closes its contacts 251 to short-circuit the winding of the relay R240. When the relay R240 restores, it closes its contacts 242 to short-circuit the winding of the relay R260. The relay R260 now releases, and opens its contacts 261 to interrupt the path short-circuiting the winding of the relay R250. The three relays R250, R240 and R260, continue to operate in a cyclic manner until the start relay R200 is deenergized, at which time they are all deenergized and restored.

During each cycle of operation of the timing relays 21, a measured ground pulse is transmitted over the display lead 288 individual to the paging connector 16. Thus, during the portion of each timing cycle when either or both of the relays R240 and R260 are operated, the display lead 288 is connected to ground over a path which includes the wiper 275, the contacts 234 and one or both sets of contacts 243 and 262. Each time the lead 288 is connected to ground, the operating circuit for the selected display control relay R380 is completed, this circuit extending by way of the grounded lead 288, the contacts 115 and 105, the wiper 171, and the winding of R380 to battery. In operating, the relay R380 completes circuits for energizing the lamps which have been preselected to display the indication which identifies the doctor No. 265 as the doctor being paged. In the present case, the three lamps 371, 372 and 373 of the display board 18, and the corresponding lamps of the other display boards, are energized by the relay R380 over circuits which respectively include the contacts 381, 382 and 383. These three lamps when thus energized at each of the display boards serve to provide an indication that the doctor assigned the page call number 265 is being paged.

The indicated lamps of the several display boards are intermittently energized under the control of the timing relays 21 until the operated switch train, comprising the line switch 12, the selector 14 and the paging connector 16, is released; an answering connection is set up by way of the answer trunk 25 to the paging connector 16; or a second indication is set up for display by the indicating lamps of the display boards by another of the paging connectors. In this last connection, it will be recalled from the preceding explanation that when the switching relay R110 operates, it closes a circuit through the resistor 222 for energizing the sequence start relay R220. The current traversing this circuit is insufficient to cause the operation of the sequence start relay. When, however, another paging connection is routed through a second paging connector, not shown, to the display control relays 19, a parallel circuit including one of the resistors 223, 224, 225, etc., is completed for energizing the sequence start relay R220. Thus if the connector individual to the resistor 223 is utilized in selecting the display control relay R390, for example, a parallel circuit, including the resistor 223, is completed for energizing the sequence start relay R220 when the switching

relay of the second paging connector operates. When the sequence start relay R220 is energized over two or more of the parallel start circuits individual to the paging connectors, it is sufficiently energized to operate. In operating, this relay closes its contacts 221 further to prepare the alternative operating circuit for the operating magnet 276 of the sequence switch 22. With the two start relays R200 and R220 operated, a current pulse is delivered to the operating magnet 276 of the sequence switch 22 during each cycle of operation of the timing relays 21. Thus, each time the timing relay R240 operates, it closes its contacts 241 to complete the above-mentioned alternative operating circuit for the magnet 276. This circuit extends from ground by way of the contacts 201, 231, 241, 232 and 221, and the winding of the magnet 276 to battery, and is obviously broken at the contacts 241 each time the timing relay R240 restores. When thus energized and deenergized, the magnet 276, in conjunction with its associated ratchet and pawl mechanism, functions to advance the wipers 273, 274 and 275 one step. Incident to this movement of the sequence switch wipers the searching operation of the sequence switch is again initiated for the purpose of finding the next paging connector through which an indication has been set up for display. In the case under consideration, only the two connectors individual to the resistors 222 and 223 are operated. Accordingly, all of the marking leads extending to the contact sets 270 and 271, with the exception of the leads 281, 282, 284 and 285, are connected to ground. Hence, the wipers 273, 274 and 275 are rapidly driven to a position wherein the contacts terminating the leads 282, 285 and 289 are engaged thereby. When these contacts are reached, no further circuit is available for energizing the test relay R230, and the circuit for energizing the magnet 276 is opened. Accordingly, the movement of the sequence switch wipers is arrested until another ground pulse is transmitted by the timing relays 21 to the magnet 276. With the wipers 273, 274 and 275 engaging the contacts terminating the conductors 282, 285 and 289, respectively, the timing relays 21 cooperate to transmit a measured ground pulse through the operated paging connector individual to the lead 289, to the display control relay R390. This relay, in operating, closes its contacts 391 and 392 to energize the two lamps 371 and 372 and the corresponding indicator lamps of the other display boards. Thus an indication is displayed which identifies the doctor who has been called from a second substation of the system. After this indication is exhibited for a predetermined time interval, the timing relay R240 interrupts the completed operating circuit for the magnet 276, whereby the wipers 273, 274 and 275 are again advanced to engage the contacts terminating the leads 281, 284 and 288. With the wipers of the sequence switch 22 in this position, another ground pulse is transmitted over the display lead 288 to cause the reoperation of the display control relay R380. From the above explanation, it will be apparent that when two or more indications have been set up for display by the indicator lamps of the display boards, the timing apparatus 20 functions to control the selected display control relays 19 so that the indications are posted in succession and without overlap between the different indications.

The doctor assigned the call number 265, upon

observing the posting of his call indication upon one of the display boards, may answer the call by dialing his answer number 365 at any one of the substations of the system. Assuming that the substation B is utilized for this purpose, the answering doctor, upon removing the receiver provided at this substation from its supporting hook or cradle, completes a loop circuit which extends by way of the line 11 to the line switch 13. This line switch now operates to seize an idle one of the selectors to which it has access. Assuming that the selector 15 is seized by the line switch 13, the calling loop circuit is extended thereto and dial tone is returned to the substation B in a manner well understood in the art. When the first digit "3" is dialed at this substation, the wipers of the selector 15 are elevated to a position opposite the level of bank contacts at which the trunks extending to the answering connectors are terminated. At the end of the digit, and during the inter-digit pause between the first and second digits, the wipers of the selector 15 are automatically rotated until the trunk extending to an idle answering connector is found. Assuming that the answering connector 17 is the first idle connector available, the selector 15, upon positioning its wipers on the contacts terminating the conductors of the trunk 27, extends the calling loop circuit to the line relay R300. When energized in this loop circuit, the relay R300 closes its contacts 302 to complete an obvious circuit for energizing the slow-to-release hold relay R310. At its contacts 301, the relay R300 opens a point in the circuit for energizing the release magnet 366, and a point in the common portion of the circuits over which impulses are transmitted to the vertical magnet 364 and the rotary magnet 365.

The hold relay R310, upon operating, connects the release conductor 27c of the trunk 27 to ground over a path including the contacts 311, thereby to mark the connector 17 as busy and to provide locking circuits which prevent the release of the selector 15 and the line switch 13. At its contacts 312, the relay R310 opens another point in the operating circuit for the release magnet 366. At its contacts 313, the relay R310 prepares the above-mentioned circuits for transmitting impulses to the vertical and rotary magnets 364 and 365. Following the operation of the hold relay R310, the answering connector 17 is conditioned to respond to the impulses of the second digit "6" of the answer number assigned to the calling doctor.

When this digit is dialed at the substation B, the loop circuit extending from this substation to the connector 17 is opened and closed six times, whereby six impulses are transmitted to the line relay R300. This relay, in following the impulses, repeats the same to the series-connected windings of the transfer relay R320 and the vertical magnet 364 over a circuit which initially includes the contacts 301, 313 and 369. Each time the relay R300 restores, it also opens its contacts 302 to interrupt the operating circuit for the hold relay R310. The latter relay, due to its slow-to-release characteristic, remains operated during impulsing.

When initially energized at the beginning of the second digit, the transfer relay R320 opens its contacts 321 to prevent the impulses from being transmitted to the transfer relay R340 and the rotary magnet 365. At its contacts 322, the relay R320 prepares a pulse by-pass path around the off-normal contacts 369. Each time the

vertical magnet 364 is energized in the pulsing circuit traced above, it operates to elevate the wipers 361 to 363, inclusive, one step so that at the end of the second digit these wipers are positioned opposite the sixth level of bank contacts in the associated contact field. Incident to the first vertical step of the wiper carriage structure, the off-normal contacts 370 are moved into engagement and the off-normal contacts 369 are disengaged. Thus the second and succeeding impulses of the second digit are transmitted to the transfer relay R320 and the vertical magnet 364 over a circuit which includes the contacts 301, 313, 370 and 322. Incident to the vertical movement of the wiper carriage structure the off-normal springs 367 are also moved into engagement to prepare the operating circuit for the release magnet 366.

Shortly following the end of the second digit the transfer relay R320 restores. In releasing, this relay opens its contacts 322 to interrupt the by-pass pulsing circuit which extends through its winding to the vertical magnet 364. At its contacts 321, the relay R320 further prepares the circuit for transmitting impulses to the transfer relay R340 and the rotary magnet 365.

When the third digit "5" of the answer number assigned to the doctor using the substation B is dialed at this substation, the loop circuit extending to the connector 17 is opened and closed five times, whereby five impulses are transmitted to the line relay R300. This relay, in following the impulses, repeats the same to the transfer relay R340 and the rotary magnet 365 over a circuit which may now be traced as extending from ground by way of the contacts 301, 313, 370, 321 and 331, the winding of R340, the contacts 352 and the winding of the rotary magnet 365 to battery. When initially energized over this circuit the transfer relay R340 closes its contacts 341 to shunt the break contacts 331 of the busy test relay R330. At its contacts 344, the relay R340 opens a point in the operating circuit for the switching relay R350. At its contacts 342, the relay R340 prepares the operating circuit for the busy test relay R330. At its contacts 343, the relay R340 opens a point in the locking circuit for the busy test relay. Due to its slow-to-release characteristic, the relay R340 remains operated until shortly after the third digit is ended. Each time the rotary magnet 365 is energized in the above-traced pulsing circuit, it functions to rotate the wipers 361 to 363, inclusive, one step so that at the conclusion of the third digit these wipers are positioned to engage the contacts of the fifth contact set in the sixth level of contacts in the associated contact field. More specifically, these wipers are operated to engage the contacts 365c, 365d and 365e at which the conductors of the answer trunk 25 are terminated.

The operations which follow the selection of the answer trunk 25 in the manner just described, depend upon the idle or busy condition of this trunk. Thus, if a connection is routed to this trunk from another substation of the system, prior to the operation of the answering connector 17 to select the trunk, the private conductor 25c is marked with ground potential over a path which includes the wiper 173 and the contacts 154 and 106. In such case, the busy test relay R330 is energized immediately the wipers of the answering connector 17 are positioned to engage the contacts 365, the circuit for energizing this relay extending by way of the grounded test con-

ductor 25c, the contact 365c, the wiper 363, the contacts 342, and the winding of R330 to battery. In operating, the relay R330 opens its contacts 331 to interrupt the initially traced operating circuit for the relay R340 and the rotary magnet 365. At its contacts 333, the relay R330 opens a point in the operating circuit for the switching relay R350. At its contacts 332, the relay R330 prepares a locking circuit for itself. This locking circuit, which includes the contacts 314 and 343, is completed at the contacts 343 when the transfer relay R340 restores shortly after the dialing of the third and final digit. In releasing, the relay R340 also opens its contacts 341 to prevent current pulses from being transmitted through its winding to the rotary magnet 365. At its contacts 342, the relay R340 opens the operating circuit for the busy test relay R330. At its contacts 344, the relay R340 prepares the operating circuit for the switching relay R350. At its contacts 334, the busy test relay R330, in operating, also completes a circuit for transmitting busy tone signaling current over the trunk 27 to the calling substation B. This circuit may partially be traced as extending from the ungrounded terminal of the busy tone generator, not shown, by way of the condenser 135, the contacts 334, the negative side of the loop extending to the substation B, the receiver provided at this substation, the positive side of the loop, and the lower winding of the line relay R300 to the grounded terminal of the busy tone generator. The current traversing this circuit is reproduced by the receiver provided at the substation B to inform the answering doctor that the paging indication displayed by the indicator lamps has already been answered. In this regard, it will be noted that the answer trunk 25 is provided for the individual use of the doctor assigned the page call number 265. Accordingly, the busy condition of this trunk as described above will not ordinarily be encountered, unless the doctor has previously instructed his secretary or one of his assistants to answer his paging indications as they are posted on the display boards.

In the case under consideration, the answer trunk 25 will normally be idle at the time it is selected through one of the answering connectors. With the answer trunk 25 idle, the test conductor 25c thereof is marked with negative battery potential through the winding of the answer relay R100, so that the busy test relay R330 is short-circuited when the wipers 361, 362 and 363 are positioned to engage the contacts 365e, 365d and 365c, respectively. Accordingly, the busy test relay does not operate. When the transfer relay R340 restores shortly after the end of the third digit, the prepared operating circuit for the switching relay R350 is completed, this circuit extending from ground by way of the contacts 314 and 333, the lower winding of R350, the contacts 344, the wiper 363 and its engaged contact 365c, the test conductor 25c, the contact 265c, the wiper 173 and the winding of R100 to battery. When energized in this circuit the relay R350 first closes its preliminary make contacts 353 to complete an obvious locking circuit for itself. Thereafter the relay R350 opens its contacts 352 to interrupt the circuit for transmitting current pulses to the rotary magnet 365. At its contacts 351, the relay R350 opens another point in the operating circuit for the release magnet 366. At its contacts 354, the relay R350 completes a more direct circuit for energizing the answer relay R100 and for impressing ground potential upon

the test conductor 25c of the answer trunk 25. This circuit extends from ground by way of the contacts 354, the wiper 363, the contact 365c, the test conductor 25c, the contact 265c, the wiper 173 and the winding of R100 to battery. At its contacts 355 and 356, the relay R350 connects the talking conductors of the trunk 27 to the line wipers 362 and 361, thereby to complete a communication circuit which includes the talking conductors 25a and 25b of the answer trunk 25 and extends between the substations A and B. After this communication circuit is completed the answering doctor and the calling executive, or other party, may converse at will. In this regard, it will be noted that current for energizing the transmitter conventionally provided at the substation A is transmitted over the loop extending to this substation through the windings of the line relay R160. Similarly, current for energizing the transmitter conventionally provided at the substation B is transmitted over the answering loop circuit through the windings of the line relay R300, the two loops being separated by the signal current coupling condensers 164 and 165.

When a communication connection is established between the substations A and B, in the manner explained above, the indication individual to the answering doctor is eliminated from the different indications which are sequentially posted on the display boards under the control of the timing apparatus 20. Thus when the answer relay R100 is energized over the above-traced circuit it operates and locks to ground over a path including the contacts 106 and 154. At its contacts 105, the relay R100 interrupts the above-traced circuit over which ground pulses are transmitted to the display control relay R380 under the control of the timing relays 21. After this circuit is opened the indication individual to the answering doctor No. 265 obviously cannot be posted on the display boards. At its contacts 104, the relay R100 opens the path, individual to the paging connector 16, over which ground potential is impressed upon the start lead 125. At its contacts 102 and 103, the relay R100 connects the two marking leads 281 and 284 to ground, so that the paging connector 16 will be passed by the sequence switch 22 during its operation successively to find the paging connectors in which indications are posted for display. At its contacts 101, the relay R100 opens the circuit, individual to the paging connector 16, over which the sequence start relay R220 is energized. In this regard, it will be understood that if only one other paging connector is operated at the time the answer relay R100 operates, the sequence start relay R220 is insufficiently energized to retain its operated position after the circuit extending through the resistor 222 is opened at the contacts 101. Accordingly, this relay will restore and open its contacts 221 to prevent further operation of the sequence switch 22. It will also be understood from the foregoing explanation that if the paging connector 16 is the only operated one of the paging connectors, the operation of the timing apparatus 20 is arrested incident to the operation of the answer relay R100. In such case the relay R100, in operating to open its contacts 104, interrupts the last available operating circuit for the start relay R200. The relay R200 accordingly restores and opens its contacts 201 to interrupt the start circuit extending to the timing relays 21. At its contacts 202, the relay R200 interrupts the circuit for energizing the test relay R230. Following the release

of the relays R200 and R230, the timing apparatus 20 is fully restored to normal.

The release of the connection established between the substations A and B through the paging connector 16 and the answering connector 17 is effected from both of these substations. Thus when the calling loop circuit is interrupted at the substation A, the line relay R160 is deenergized and restores. In releasing, this relay opens its contacts 161 to deenergize the hold relay R150. The latter relay restores, after an interval, and opens its contacts 151 to disconnect the release conductor 26c of the trunk 26 from ground and thus open the locking circuits for the operated relays of the selector 14 and the line switch 12. When the last-mentioned relays are deenergized the selector 14 and the line switch 12 are released in a manner well understood in the art. In restoring, the hold relay R150 also opens its contacts 154 to interrupt the locking circuits for the relays R160 and R110. At its contacts 153, the relay R150 completes a circuit including the contacts 162 and the off-normal springs 176 for energizing the release magnet 182. This magnet, in operating, attracts its associated holding pawl, whereby the wiper carriage structure of the connector 16 is restored to rotary and vertical normal, in the usual manner. Incident to the release of the Strowger switching mechanism, the off-normal contacts 178 are disengaged, the off-normal contacts 179 are moved into engagement, and the off-normal contacts 176 are disengaged to deenergize the release magnet 182. Following the release of the magnet 182, the connector 16 is fully restored to normal. The manner in which the paging connector 16 is released, when a connection is set up therethrough to an operated or busy one of the display control relays, is substantially the same as described above. In the latter case, however, the two relays R100 and R110 are not operated. On the other hand, the busy test relay R130, which is operated, is deenergized and restores incident to the release of the hold relay R150. In the event no answering connection is established through the paging connector 16 in the manner explained above, the answer relay R100 is not operated at the time the call is abandoned at the calling substation A. In this case the release of the connection is effected in the exact manner described above. The display of the indication set up through the connector 16 continues, however, until the switching relay R110 restores. In releasing, the relay R110 exercises the same control over the timing apparatus 20, as is accomplished through operation of the answer relay R100 in the manner explained above.

When the above described connection set up between the substations B and A is cleared out at the substation B, the calling loop circuit extending from this substation to the answering connector 17 is interrupted to cause the deenergization and release of the line relay R300. Upon restoring, this relay closes its contacts 301 further to prepare the operating circuit for the release magnet 366, and opens its contacts 302 to deenergize the hold relay R310. The latter relay restores after an interval and opens its contacts 314 to cause the deenergization and release of the switching relay R350. At its contacts 312, the relay R310 further prepares the operating circuit for the release magnet 366. At its contacts 311, the relay R310 disconnects the release conductor 27c of the trunk 27 from ground, whereby the selector 15 and the line switch 13 are caused to

release, in the usual manner. The relay R350, upon restoring, closes its contacts 351 to complete the prepared operating circuit for the release magnet 366, this circuit extending by way of the contacts 301, 312 and 351, the off-normal springs 367 and the winding of the magnet 366 to battery. At its contacts 354, the relay R350 disconnects the private wiper 363 from ground to open one of the paths over which ground potential is impressed upon the test conductor 25c of the answer trunk 25. When the release magnet 366 is energized, it attracts its associated holding pawl to permit the wipers 361, 362 and 363 to be returned to rotary and vertical normal, in the usual manner. Incident to the release of these wipers, the off-normal springs 367 are disengaged to deenergize the release magnet 366, the off-normal contacts 370 are disengaged, and the off-normal contacts 369 are moved back into engagement. Following the release of the magnet 366 the answering connector 17 is fully restored to normal. In the event the answering connection, as routed from the substation B through the line switch 13, the selector 15 and the answering connector 17 to the answer trunk 25, is not extended to the substation A due to the busy condition of the trunk, the three enumerated switching units may be released from the substation B in substantially the exact manner described above. In this case, however, the switching relay R350 is not operated. On the other hand, the busy test relay R330, which is operated, is deenergized and restores in response to the release of the hold relay R310.

It may occur that the paging indication as posted on the various display boards through the paging connector 16, in the manner explained above, will not be answered by the person paged, or one of his subordinates, before the calling end of the connection is cleared out at the calling substation. In such case if an answering connection is routed through the line switch 11, the selector 15 and the connector 17, to the answer trunk 25, neither the busy test relay R330 nor the switching relay R350 is operated incident to the release of the transfer relay R340. Accordingly, the doctor answering the page call at the substation B fails to receive busy tone or to obtain a connection with the calling party. The absence of the busy tone signal and the "dead" character of the connection indicates to the doctor that the call has been abandoned before it was answered. Accordingly he may restore the receiver provided at the substation B to its supporting hook or cradle to initiate the release of the operated switch train, in the exact manner described above.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a combined communication and paging system, a display board including indicators selectively controllable to display indications of the persons who may be paged over said system, a pair of signaling stations, a paging selector directly controllable from one of said stations to impart a predetermined setting to said indicators and to set up an answering circuit which extends to said one station, and an answering selector directly controllable from the other

of said stations to set up a communication connection which includes said answering circuit and extends between said stations.

2. In a combined communicating and paging system, a display board including indicators selectively controllable to display indications of the persons who may be paged over said system, said persons being assigned different answer signals, a pair of signaling stations each equipped with means for transmitting said answer signals, a paging selector directly controllable from either of said stations to impart a predetermined setting to said indicators and to set up an answering circuit which is identified by one of said answer signals, and automatic switching equipment operative to seize said answering circuit when the signal transmitting means at the other of said stations is operated to transmit said one answer signal, thereby to establish a communication connection which includes said answer circuit and extends between said stations.

3. In a combined communicating and paging system, a display board including indicators selectively controllable to display indications of the persons who may be paged over said system, said persons being assigned different call and answer numbers, a pair of signaling stations each equipped with means for transmitting said call and answer signals, a paging selector directly controlled to impart a predetermined setting to said indicators and to set up an answer circuit which is individual to one of said persons when the transmitting means at one of said stations is operated to transmit the call signal identifying said one person, and automatic switching equipment operative to seize said answering circuit when the signal transmitting means at the other of said stations is operated to transmit the answer signal identifying said one person, thereby to establish a communication connection which includes said answer circuit and extends between said stations.

4. In a combined communicating and paging system, a plurality of signaling stations, a paging selector directly controllable from any one of said stations and having a plurality of different settings individually corresponding to the persons who may be paged over said system, a display board including indicators selectively controlled in accordance with the operation of said selector to display different indications individually corresponding to the different settings of said selector, an answering selector directly controllable from any one of said stations and operative to different settings individually corresponding to the settings of said paging selector, and means including answer trunks connecting corresponding outlet contacts of said selectors for establishing a communication connection which extends through said selectors between two of said stations, each time said selectors are operated to corresponding settings.

5. In a combined communicating and paging system, a plurality of signaling stations each including a signal transmitting device operative to transmit call and answer signals individually designating the persons who may be paged over said system, a paging selector directly controllable by said call signals and having a plurality of settings individually corresponding to said persons, a display board including indicators selectively controlled in accordance with the operation of said selector to display different indications individually corresponding to the different settings of said selector, an answering selector

directively controlled by said answer signals and operative to different settings individually corresponding to the settings of said paging selector, and means including answer trunks connecting corresponding outlet contacts of said selectors for establishing a communication connection which extends through said selectors between two of said stations, each time said selectors are operated to corresponding settings.

6. In a combined communicating and paging system, a plurality of signaling stations, a plurality of paging selectors each directly controllable from any one of said stations and each having a plurality of different settings individually corresponding to the persons who may be paged over said system, a display board including indicators selectively controllable in accordance with the operation of said selectors to display indications individually corresponding to the settings of operated ones of said selectors, a plurality of answering selectors each directly controllable from any one of said stations and each having different settings which individually correspond to the different settings of said paging selectors, and means including answer trunks multiplied to the corresponding outlet contacts of all of said selectors for establishing a communication connection between two of said stations each time one of said paging selectors and one of said answering selectors are concurrently operated to corresponding settings.

7. In a combined communicating and paging system, a plurality of signaling stations each including a signal transmitting device operative to transmit call and answer signals individually designating the persons who may be paged over said system, a plurality of paging selectors each directly controllable by said call signals and each operative to different settings individually corresponding to said call signals, a display board including indicators selectively controllable in accordance with the operation of said selectors to display different indications individually corresponding to the settings of operated ones of said selectors, a plurality of answering selectors each directly controlled by said answer signals and each having different settings which individually correspond to the different settings of said paging selectors, and means including answer trunks multiplied to the corresponding outlet contacts of all of said selectors for establishing a communicating connection between two of said stations each time one of said paging selectors and one of said answering selectors are concurrently operated to corresponding settings.

8. In a combined communicating and paging system, a plurality of signaling stations, a plurality of paging selectors each directly controllable from any one of said stations and each having a plurality of different settings individually corresponding to the persons who may be paged over said system, a display board including indicators selectively controllable in accordance with the operation of said selectors to display indications individually corresponding to the settings of operated ones of said selectors, means controlled from said paging selectors for causing said indicators sequentially to display said different indications, a plurality of answering selectors each directly controllable from any one of said stations and each having different settings which individually correspond to the different settings of said paging selectors, and means including answer trunks multiplied to the corresponding outlet contacts of all of said selectors for es-

establishing a communication connection between two of said stations each time one of said paging selectors and one of said answering selectors are concurrently operated to corresponding settings.

9. In a combined communicating and paging system, a plurality of signaling stations each including a signal transmitting device operative to transmit call and answer signals individually designating the persons who may be paged over said system, a plurality of paging selectors each directly controllable by said call signals and each operative to different settings individually corresponding to said call signals, a display board including indicators selectively controllable in accordance with the operation of said selectors to display different indications individually corresponding to the settings of operated ones of said selectors, means controlled from said paging selectors for causing said indicators sequentially to display said different indications, a plurality of answering selectors each directly controlled by said answer signals and each having different settings which individually correspond to the different settings of said paging selectors, and means including answer trunks multiplied to the corresponding outlet contacts of all of said selectors for establishing a communication connection between two of said stations each time one of said paging selectors and one of said answering selectors are concurrently operated to corresponding settings.

10. In a combined communicating and paging system, a plurality of signaling stations, a paging selector directly controllable from any one of said stations and having a plurality of different settings individually corresponding to the persons who may be paged over said system, a display board including indicators selectively controlled in accordance with the operation of said selector to display different indications individually corresponding to the different settings of said selector, an answering selector directly controllable from any one of said stations and operative to different settings individually corresponding to the settings of said paging selector, means including answer trunks connecting corresponding outlet contacts of said selectors for establishing a communication connection which extends through said selectors between two of said stations, each time said selectors are operated to corresponding settings, and means operative in response to the completion of a communication connection through said selectors for wiping out the indication displayed by said indicators.

11. In a combined communicating and paging system, a plurality of signaling stations, a plurality of paging selectors each directly controllable from any one of said stations and each having a plurality of different settings individually corresponding to the persons who may be paged over said system, a display board including indicators selectively controllable in accordance with the operation of said selectors to display indications individually corresponding to the settings of operated ones of said selectors, means controlled from said paging selectors for causing said indicators sequentially to display said different indications, a plurality of answering selectors each directly controllable from any one of said stations and each having different settings which individually correspond to the different settings of said paging selectors, means including answer trunks multiplied to the corresponding outlet con-

tacts of all of said selectors for establishing a communication connection between two of said stations each time one of said paging selectors and one of said answering selectors are concurrently operated to corresponding settings, and means responsive to the completion of a connection through any one of said paging selectors for eliminating the indication which corresponds to the setting of said one paging selector from the sequence of indications displayed by said indicators.

12. In a combined communicating and paging system, a plurality of signaling stations each including a signal transmitting device operative to transmit call and answer signals individually designating the persons who may be paged over said system, a plurality of paging selectors each directly controllable by said call signals and each operative to different settings individually corresponding to said call signals, a display board including indicators selectively controllable in accordance with the operation of said selectors to display different indications individually corresponding to the settings of operated ones of said selectors, means controlled from said paging selectors for causing said indicators sequentially to display said different indications, a plurality of answering selectors each directly controlled by said answer signals and each having different settings which individually correspond to the different settings of said paging selectors, means including answer trunks multiplied to the corresponding outlet contacts of all of said selectors for establishing a communication connection between two of said stations each time one of said paging selectors and one of said answering selectors are concurrently operated to corresponding settings, and means responsive to the completion of a communication connection through any one of said paging selectors for eliminating the indication which corresponds to the setting of said one paging selector from the sequence of indications displayed by said indicators.

13. In a combined communicating and paging system, a plurality of paging selectors each having a plurality of different settings individually corresponding to the persons who may be paged over said system, a display board including indicators selectively controllable in accordance with the operation of said selectors to display indications which individually correspond to the settings of operated ones of said selectors, means controlled from said selectors for causing said indicators sequentially to display said different indications, means for setting up communication connections through operated ones of said selectors, and means responsive to the completion of a communication connection through any one of said selectors for eliminating the indication which corresponds to the setting of said one selector from the sequence of indications displayed by said indicators.

14. In a combined communicating and paging system, a display board including indicators for displaying different indications designating the different persons who may be paged over said system, means for selectively controlling said indicators so that a plurality of indications designating different persons are sequentially displayed thereby, communication facilities over which paged persons may answer and acknowledge the indications displayed by said indicators, and means responsive to the answering of an indication over said communication facilities for eliminating the answered indication from the

sequence of indications displayed by said indicators.

15. In a combined communicating and paging system, a display board including indicators for displaying different indications designating the different persons who may be paged over said system, communication facilities including a plurality of substations and means for setting up connections between said substations over which paged persons may answer and acknowledge the indications displayed by said indicators, means controllable from said substations for selectively controlling said indicators so that a plurality of indications designating different persons are sequentially displayed thereby, and means responsive to the setting up of a connection for answering one of said indications for eliminating said one indication from the sequence of indications displayed by said indicators.

16. In a combined communicating and paging system, a display board including indicators for displaying different indications designating the different persons who may be paged over said system, means for selectively controlling said indicators so that a plurality of indications designating different persons are sequentially displayed thereby, communication facilities over which paged persons may answer and acknowledge the indications displayed by said indicators,

means responsive to the answering of an indication over said communication facilities for eliminating the answered indication from the sequence of indications displayed by said indicators, and means for arresting the successive display of different indications when the number of indications to be displayed falls below a predetermined number.

17. In a combined communicating and paging system, a display board including indicators for displaying different indications designating the different persons who may be paged over said system, communication facilities including a plurality of substations and means for setting up connections between said substations over which paged persons may answer and acknowledge the indications displayed by said indicators, means controllable from said substations for selectively controlling said indicators so that a plurality of indications designating different persons are sequentially displayed thereby, means responsive to the setting up of a connection for answering one of said indications for eliminating said one indication from the sequence of indications displayed by said indicators, and means for arresting the successive display of different indications when the number of indications to be displayed falls below a predetermined number.

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