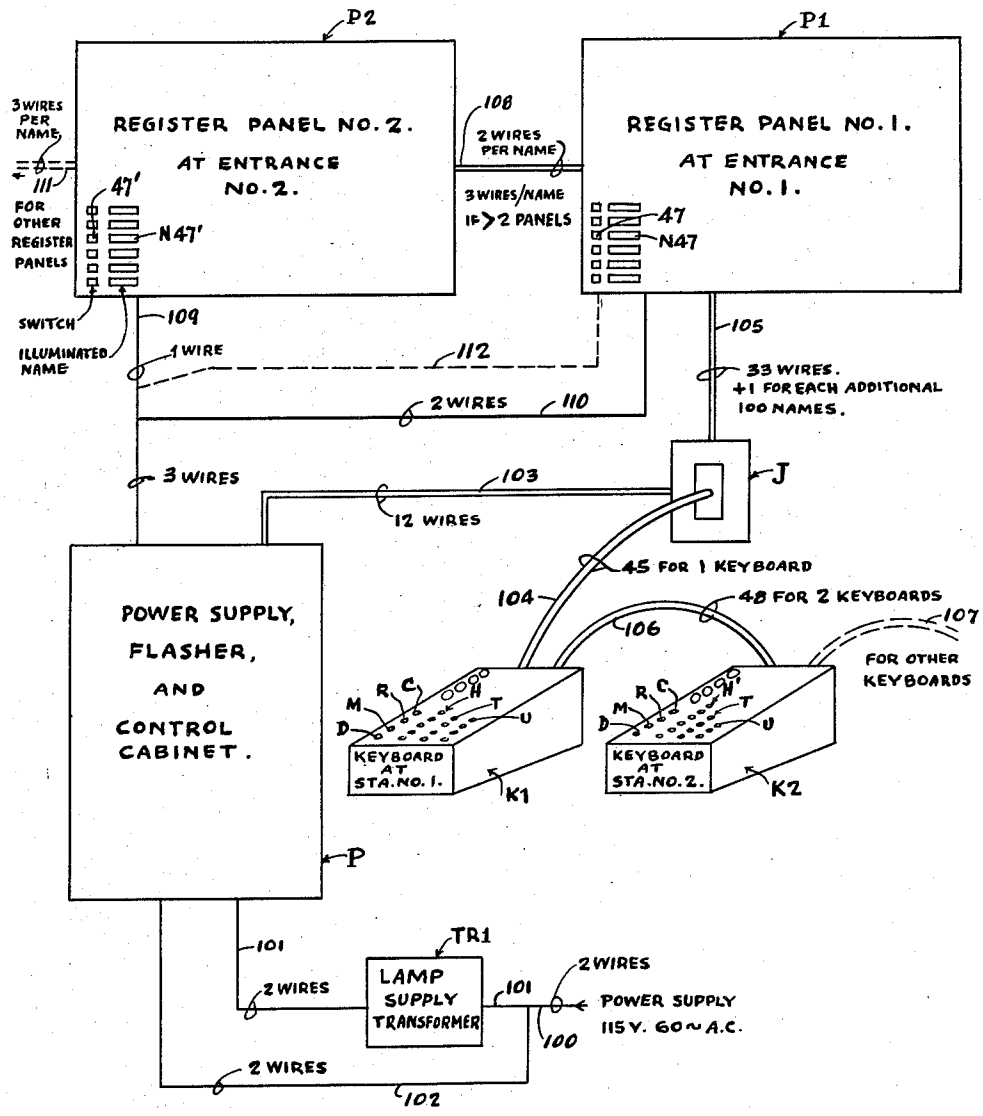
June 10, 1958 H. RUMLER ET AL 2,838,749

IN-AND-OUT REGISTER AND PAGING SYSTEM

Filed June 14, 1954 5 Sheets-Sheet 1

FIG - 1



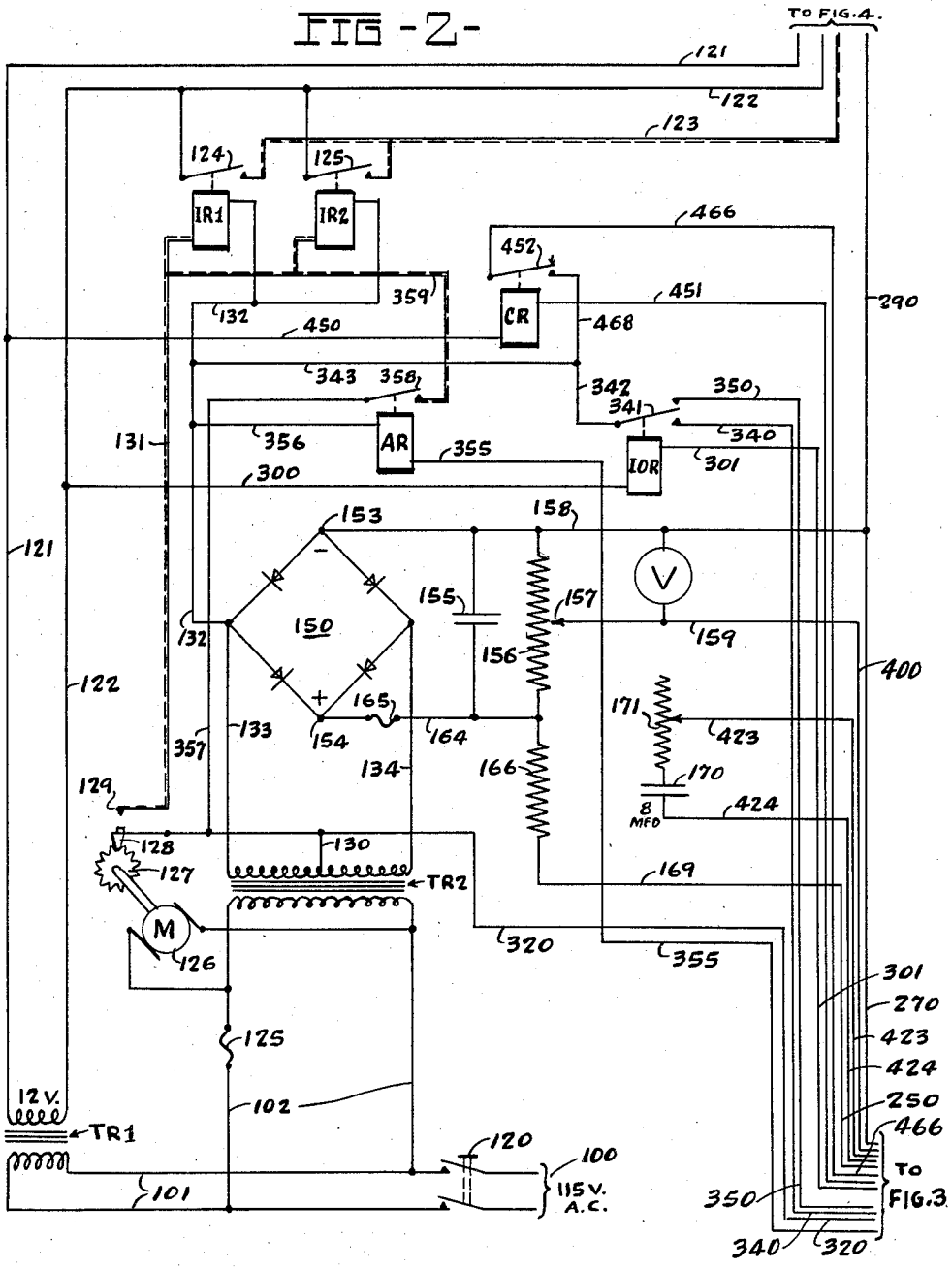
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ATTY.

June 10, 1958 H. RUMLER ET AL 2,838,749

IN-AND-OUT REGISTER AND PAGING SYSTEM

Filed June 14, 1954 5 Sheets-Sheet 2

FIG -2-



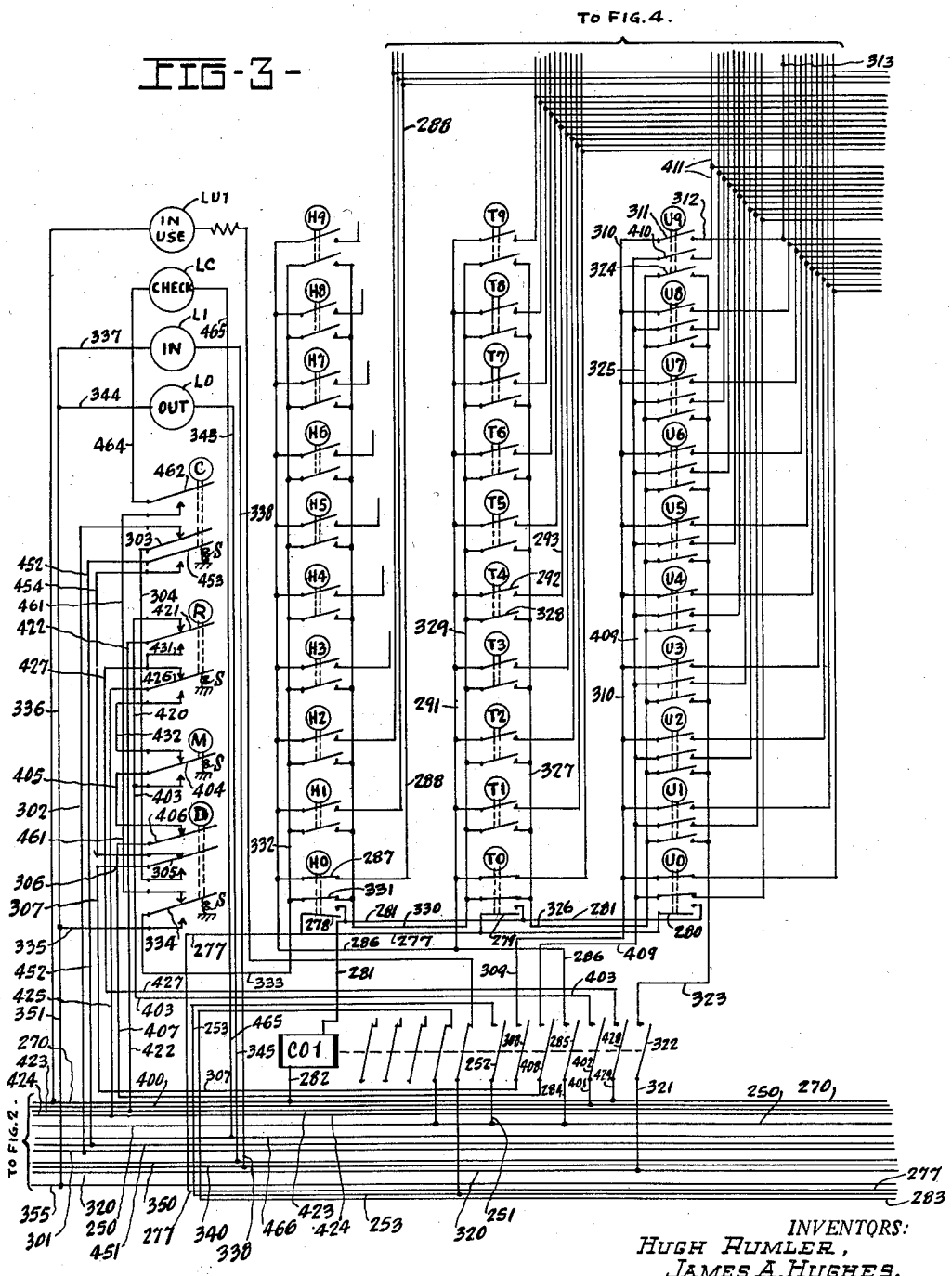
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June 10, 1958 H. RUMLER ET AL 2,838,749

IN-AND-OUT REGISTER AND PAGING SYSTEM

Filed June 14, 1954 5 Sheets-Sheet 3

FIG-3-

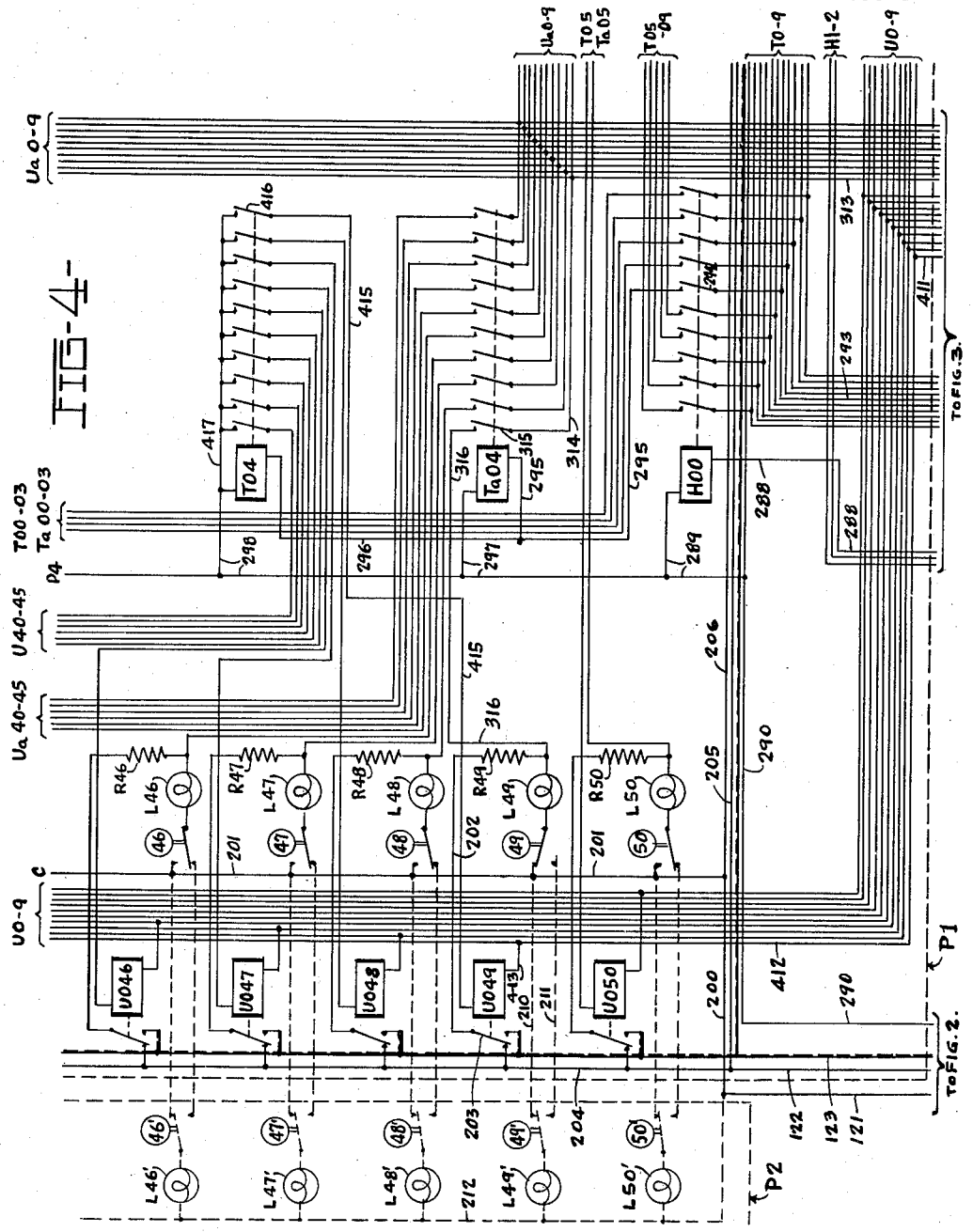


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IN-AND-OUT REGISTER AND PAGING SYSTEM

Filed June 14, 1954 5 Sheets-Sheet 4



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IN-AND-OUT REGISTER AND PAGING SYSTEM

Filed June 14, 1954 5 Sheets-Sheet 5

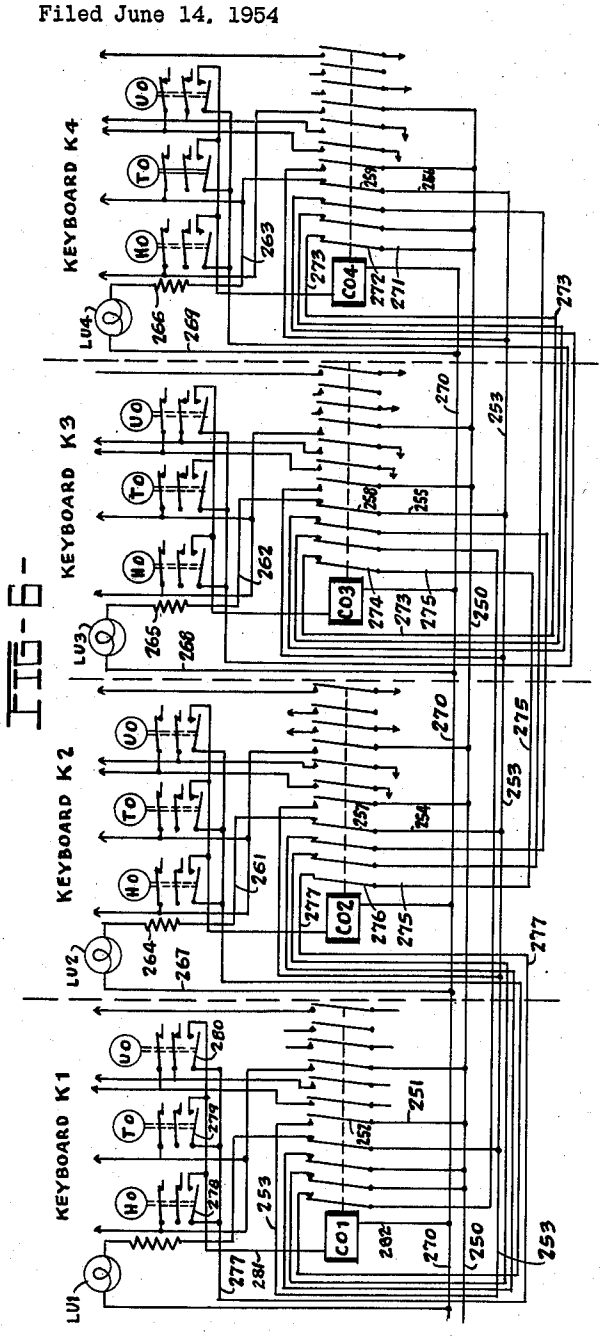


FIG-5-

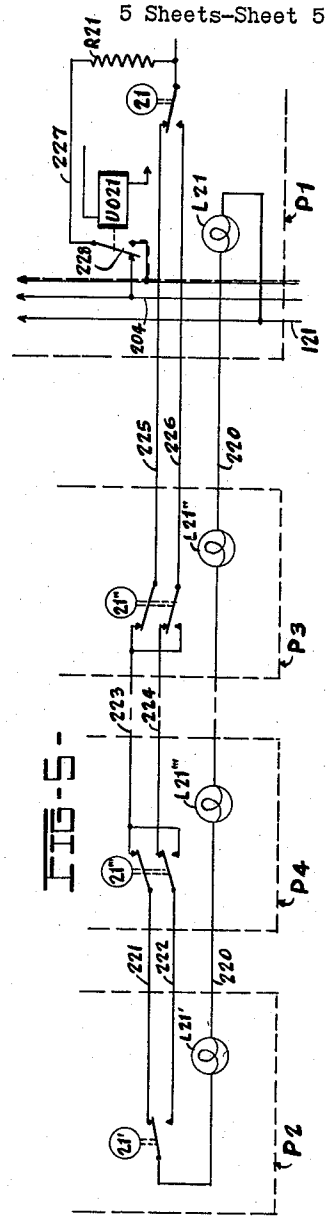


FIG-5-

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United States Patent Office 2,838,749 Patented June 10, 1958

2,838,749

IN-AND-OUT REGISTER AND PAGING SYSTEM

Hugh Rumler, Petersburg, and James A. Hughes, Adrian, Mich., assignors to Sperti Faraday Inc., Cincinnati, Ohio, a corporation of Ohio

Application June 14, 1954, Serial No. 436,438

17 Claims. (Cl. 340—312)

This invention relates to an electric signalling system. More particularly it deals with a combined in-and-out register and paging system for persons in a region or building, such as for example, doctors visiting a hospital in which said doctors may indicate their presence or departure at any one or a plurality of entrances to said hospital, which indications may be detected at one or more central stations, and/or any one or more doctors may be paged at all said entrances from any one of said central stations.

This invention is an improvement of the system described in the copending application of Slocum et al., Serial No. 229,938, filed June 5, 1951, now U. S. Patent No. 2,682,654 issued June 29, 1954, which has been assigned to the same assignee as this invention. The improvement of this invention resides, together with different structural and circuit changes, in the adaptation of said Slocum et al. system to a plurality of register panels which may be located at different entrances to the region, building or hospital, and/or to a plurality of keyboards or central control stations from any one of which registering and paging detections and indications may be made.

It is an object of this invention to produce a simple, efficient, effective and economic multiple indicating and control in-and-out register and paging system.

Another object is to produce such a system which occupies a relatively small space, requires relatively little material, has relatively few circuit connections, and requires a relative short time and little skill for its installation.

Another object is to produce such a system in which a plurality of register panels for the same person to be registered, may be placed at different and separate locations, all of which panels operate in unison, and all of which may be surveyed and controlled by any one of one or more control stations.

Another object is to produce such a system in which a plurality of similar control stations at different and separate locations may, one at a time, be employed to determine, for any one person, whether or not that person is registered, has been paged, and/or to page or cancel the paging of that person on all the register panels.

Another object is to produce such a paging and registering system in which the paging and registering conditions set up in the system are maintained operated until they are positively cancelled, regardless of whether or not the power supply to the system is interrupted.

Another object is to produce such a system in which a paging condition for any person may be checked at any one of a plurality of control stations without cancelling, resetting or changing the paging condition.

Another object is to produce such a system in which a common selecting circuit is employed for the registering, the paging and the checking operations of the system.

Another object is to provide an in-and-out personnel registering and paging system for a region or building

in which an electric light indicates the presence or absence of a person within the region, both at all of the separate register panels located at different entrances to the region and selectively and separately at any one of a plurality of central station, and in which an operator at any one of the central stations may page a selected person by causing his light to flash on the panels until cancelled by an operator at one of the central stations.

Generally speaking, the system of this invention comprises:

(1) One or more separate register panels, each comprising a plurality of registers, one for each person to be registered and paged, each register comprising: a plate indicating the corresponding person's name and/or number, a signalling device such as an electric light, buzzer or the like, and a bi-stable switch to be operated by the corresponding person when entering and leaving the region in which the present system is installed to control said signalling device to indicate the presence and absence of said person, respectively; with one of the panels also including a register selecting device and a separate paging device for each person to be paged;

(2) One or more operator keyboards located at a central control station or stations, each comprising: numerical means for operating said register selecting device to select the register or registers corresponding to a given person, means to detect the presence and absence (in-and-out) indicating conditions of said signalling device, separate means to set up and cancel the operation of the corresponding paging device for that person which may cause said signalling device to operate in a different or irregular manner from that of indicating the presence or absence of that person within the region, means for determining whether or not a paging signal has previously been set up for that person on his register by one of said keyboards, and means for indicating whether or not another keyboard is in use; and

(3) A power supply unit and connections for the register panels and keyboards for furnishing and controlling both A. C. and D. C. currents of different potentials through electrical conductors for carrying out the functions of the above mentioned parts of the system.

The selecting device in one of the panels of the system may comprise a plurality of relays, such as for example if a decimal system for over a hundred persons with corresponding numbers is employed, one relay with ten contacts for each hundred digit and separate relays with ten contacts for each tens digit in each hundred. The separate paging devices in said one panel may each comprise a bi-stable relay with a pair of contacts which may change the connection to the corresponding signalling device or devices, such as electric lights, to cause them to flash (for paging) or not when lit by the operation of the bi-stable switch of the corresponding register. The corresponding register on each of a plurality of panels may thus be connected in parallel and series so that their switches and signalling devices operate in unison and may be controlled by only one selecting device and one set of paging devices.

All of the separate operator control keyboards of the system are connected in parallel with each other to the main or one control register panel having the selecting and paging devices. Each keyboard is the same and each may comprise digital rows of selecting keys and switches corresponding to the digits of the numbers of the names of the persons listed on the register panels. These digital rows of keys or buttons are preferably interconnected so that only one button in each row may be operated at one time, like on an adding machine, and each row may have one key to be operated for its home or out of use position, connected to which one keys may be a circuit to operate the "in use" signals on

the keyboards of the system when not in their home position. In addition to the selecting switches on each of the keyboards, manual push button control switches some of which operate separate signalling devices, such as lights, on the same keyboard to indicate "in" or "out" condition of a selected register, are provided to operate and cancel the operation of a selected paging device, and to check if a selected paging device has been operated or not. If a plurality of keyboards are employed, each keyboard is provided with a cut out or locking out device so that only one of the keyboards may be operated at a time and one cannot interfere with the selection being made by another.

The above mentioned and other features and objects of this invention and the manner of attaining them are given more specific disclosure in the following description of embodiments of this invention in conjunction with the accompanying drawings, wherein:

Fig. 1 is a schematic block diagram showing in full lines the general parts of the system of this invention adapted for only two separate register panels and two separate keyboards;

Fig. 2 is a wiring diagram of the electrical circuits of the power supply portion of the system shown in Fig. 1, with lines showing how it may be connected to the wiring diagram of Figs. 3 and 4;

Fig. 3 is a wiring diagram of the electrical circuits of the first keyboard shown in Fig. 1 together with lines showing how it may be connected to the wiring diagrams of Figs. 1 and 4, and to another similar keyboard circuit;

Fig. 4 is a wiring diagram of the lower left hand corner of a main or control register panel including the selecting device and paging devices for a 300 register or name system arranged with six vertical columns of fifty registers each, showing in detail the electric circuits for the last five registers of the first column and their corresponding paging and selecting device circuits with lines showing how this panel is connected to the wiring diagrams of Figs. 2 and 3, other register and selecting device relays in this panel, and by dotted lines how the five registers shown may be connected to corresponding registers in another panel of a two panel system;

Fig. 5 is a wiring diagram of the circuits interconnecting corresponding registers for one person in a multi-register panel system, namely four panels; and

Fig. 6 is a wiring diagram of the circuits for interconnecting four separate keyboards in a system, showing only those parts of the keyboard circuits (see Fig. 3) necessary for indicating the "in use" information and preventing two or more keyboards from being operated at the same time.

I. THE INSTALLATION EQUIPMENT

Referring to Fig. 1, there is shown schematically different parts of the apparatus involved in the registering and paging system of this invention indicating the number of wires required in each of the cable connections between the different parts of the apparatus. The electrical current source **100** may be an ordinary domestic 110 or 115 volts 60 cycle A. C. source and may be connected through cables **101** and **102** to both a power supply and control cabinet as well as to a lamp supply transformer **TR1** that may be physically separated from the power supply control cabinet P as shown in Fig. 1. This power supply unit may be located at any convenient location in a building, but preferably near one of the keyboards to save as much wiring as possible. Between the power supply unit P, keyboard **K1** and control register panel **P1** there may be provided a junction box J in which the cable **103** from the power supply unit may be properly connected with the wires in the larger cables **104** and **105** extending between the panel **P1** and keyboard **K1**. Additional keyboards, such as keyboard **K2**, may be directly connected in series and parallel to the keyboard **K1** through cables **106** and **107** or they may be connected to a junction box J, which ever is the most convenient and shorter distance for wiring.

If an additional and second register panel **P2** is also employed, a cable **108** is provided between the panels **P1** and **P2** which cable comprises two wires for each register on the panel **P1** which are connected to the corresponding registers on panel **P2**, and lamp supply conductor cables **109** and **110** may be connected respectively from the panels **P2** and **P1** directly to the power supply unit P. However, if more than two register panels are employed, then three wires per register are necessary in the cables **108** and **111** between each of the panels **P1**, **P2**, **P3**, **P4** in series (see Fig. 5) and the common conductor **109** is then connected via a cable **112** to the register panel **P1**, or preferably is included in cable **110**.

There is shown on each panel **P1** and **P2** a few of the corresponding registers with their manual switches **47** and **47'** and their respective illuminated or translucent name plates **N47** and **N47'** for the particular person corresponding to the number "**47**" of the 300 different numbers and names on each of the panels **P1** and **P2**.

The register panels **P1** and **P2** are preferably located at the entrances of the region, building or hospital in which the system is to be installed so as the doctor enters or leaves the building he may operate his manual register switch on the panel corresponding to his name, to indicate his entrance into or departure from the building or region. Although the register switches such as **47** and **47'** on panels **P1** and **P2** are bi-stable switches indicating "in" and "out" conditions, it is not necessary to mark these positions correspondingly, in that when the switch is in its "in" position the light corresponding to that position will be lit at or behind the name plate **N47** and **N47'** so that the doctor as he operates his switch may see that the proper condition is registered by his switch.

On each of the keyboards **K1** and **K2** there may be provided three digital rows H, T and U of selecting keys for the hundreds, tens and units digits, respectively, of the numbers corresponding to the names listed on the panels **P1** and **P2**, and the four push button switches D, M, R and C for respectively detecting, message paging, message release, and message checking together with four associated indicating lights "in," "out," "check," and "in use." (See also Fig. 3.) The central control stations **K1** and **K2** are preferably located at the main office and where messages may be received, such as from a telephone operator, at an information desk, etc. in a hospital. Since each person's name on each of the panels **P1** and **P2** is assigned a number of three digits, any one of this person's registers may be selected by operating one of the keys in each row of keys 0 to 9 on one keyboard to set up the number corresponding to that person, such as for example if a doctor or person having the number **47** is to be called then the keys **H0**, **T4** and **U7** should be pressed.

After such a numerical selection has been made on one of the keyboards, then one of the four spring resistant push buttons D, M, R or C may be pressed for the following desired information or paging: button D is operated to indicate whether the switch **47** or **47'** has been operated to show whether the corresponding doctor is "in" or "out" by lighting the corresponding "in" or "out" light on that particular keyboard. Button M is operated to cause the corresponding lights **L47**, **L47'**, etc. (see Fig. 4) behind the name plates **N47**, **N47'**, etc., on all the panels **P1**, **P2**, etc., to flash, if it is on or when it is switched on by the doctor entering the building at one of the register panels. Button R is operated to stop the light from flashing or to cancel the paging signal to a doctor in the event the doctor has answered his message by calling at the station of a keyboard **K1** or **K2**, or in the case when a message is no longer required to be given to the doctor. Button C is operated when it is desired to check to see if a paging message has or has not already been set up for the doctor or if the units relay **U47** correspond-

ing to the register 47 of the particular doctor selected has been operated to cause flashing of the lights L47 if or when they come on, in which event the "check" light on the keyboard is correspondingly flashed.

The fourth indicating light "in use" which herein is shown in the upper right hand corner of each of the keyboards K1, K2, etc., is extinguished if no one of the keyboards K1, K2, etc. is in operation, but as soon as one of the keyboards is in operation, this "in use" light on all the other keyboards is lit so that the operator at those other keyboards knows she must await the extinguishment of her "in use" light before setting up a selection.

II. THE POWER SUPPLY

Referring to Fig. 2 power supply conductors 100 may be connected to a double pole switch 120 before being connected to conductors 101 and 102 to transformers TR1 of the lamp supply circuit and the transformer TR2 for the control and rectifier circuit. The output across conductors 121 and 122 from the secondary winding of the lamp transformer TR1 may be at a reduced A. C. voltage, say about 12 volts, and is employed for energizing the electric lamps or signal devices throughout the system. One of the conductors 102 may be provided with a suitable circuit breaker or fuse 125 and between it and the primary winding of transformer TR2 there may be connected an electric motor 126 of an interrupter device, which electric motor may drive a toothed cam 127 to oscillate a cam follower 128 that alternately opens and closes a pair of contacts 129 in an A. C. circuit taken from the secondary of transformer TR2 to operate a parallel pair of A. C. interrupting relays IR1 and IR2 having contacts 124 and 125 to produce an intermittent or flashing current from the A. C. lamp conductor 122 in a conductor 123 parallel to the conductor 122. This A. C. circuit may be traced from the center tap 130 of transformer TR2 through the interrupter contacts 129, conductor 131 to each of the relays IR1 and IR2 in parallel, and then from each of these relays in parallel through conductors 132 and 133 to one of the end terminals of the secondary winding of the transformer TR2. For illustration purposes those conductors carrying interrupted A. C. current are shown with a dashed line superimposed upon them.

Directly connected across the end terminals of the secondary winding of the transformer TR2 through conductors 133 and 134 is a full wave rectifier 150 having a negative D. C. terminal 153 and a positive D. C. terminal 154 from which the paging devices of the system are operated and released under the control buttons M and R on the keyboards described later in chapter VI. Across these terminals 153 and 154 may be connected a condenser 155 (for example of 150 microfarads capacity) to smoothen out the ripples in the outputs of the rectifier. Also across these terminals 153 and 154, in parallel with the condenser 155, is a resistance 156 from which a given D. C. voltage may be selected by means of a variable tap 157 between which tap and conductor 158 to terminal 153 may be connected a volt meter V.

Another D. C. potential for operating the relays of selecting device in the main control register panel P1 may be taken from the positive terminal 154 of the rectifier 150 through a fuse 165 and a resistance 166 (of say 160 ohms) to a conductor 169 to the keyboards.

For reversing the potential through the bi-stable units relays of the paging devices in the panel P1, a circuit is provided through an additional condenser 170 (say of 8 microfarads capacity) which may be located in the cabinet P and connected there in series with a variable resistance 171. This condenser is charged from output terminals 153 and 154 of rectifier 150 and then discharged through a paging device to release it as will be described later in Chapter VI.

The power supply circuit of Fig. 2 may also include several control relays, such as: in-and-out relay IOR and anti-flashing relay AR both controlled by the operation of the detecting button D on the keyboards and checking relay CR controlled by the checking button C on the keyboards. The operations of these relays will be described later in connection with the operations of their control buttons.

III. THE REGISTERING CIRCUIT

Referring to Fig. 4 there is shown the circuits for five consecutive registers of the control panel P1 provided with bi-stable switches 46, 47, 48, 49 and 50 and corresponding signal lights L46, L47, L48, L49 and L50. One contact of each of these manual switches 46—50 is connected to the common lamp supply conductor 121 from the power supply unit P through connecting conductors 200 and 201. When this circuit is open through one of said manual switches, the person corresponding to said open switch has registered he is "out" of the region and his corresponding signal light is extinguished. For the purpose of illustration let us assume that the person or doctor corresponding to the manual switch 49 is "in" so that current from the common conductor 121 completes the circuit from one terminal of the secondary transformer TR1 in the power supply unit of Fig. 2 through the conductors 121, 200, 201, switch 49, lit signal lamp L49, through resistance R49, conductor 202, contacts 203 of the units bi-stable paging relay U049, conductors 204 and 122 back to the other terminal of the secondary transformer TR1 in Fig. 2. The open condition for similar circuits is shown for the switches 46, 47, 48 and 50, in which their corresponding lights L46, L47, L48 and L50 are not lit because their registers indicate "out" for their corresponding persons. The purpose of the resistors R46—R50 in these circuits is to control the voltage to prevent the shunting out of the in-and-out relay IOR in Fig. 2 when the corresponding signal lights L46—L50 are lit and this condition is being detected by operation of the detecting button D on a keyboard as will be described later in Chapter V.

The circuits for all the registers, each of which is provided with a units bi-stable paging relay U-001—U-300, are similarly connected to branches of the conductors 204 and 200 through conductors 205 and 206, respectively.

If two separate register panels are employed a connection between them may be made as shown in dotted lines in Fig. 4 in which the second panel P2 has signal lamps L46′—L50′ corresponding to the registers in panel P1. The two panels P1 and P2 are provided with two separate contacts for each of the switches 46—50 and 46′—50′, which contacts are shown directly connected together by conductors 210 and 211 for the register of person "49," which conductors form part of the cable 108 shown in Fig. 1. Thus when either one of the switches 49 or 49′ is operated, neither or both of the lights L49 and L49′ will light. In this instance of two panels only, the common conductor 121 may be directly connected to the conductor 212 in panel P2, instead of the conductors 200 and 201 in panel P1, to complete the circuit through cable 109 shown in Fig. 1.

If more than two register panels are employed, say for example four panels P1, P2, P3 and P4 as shown in Fig. 5, having one main or control panel P1, a final panel P2, and intermediate panels P3 and P4, the circuits for panels P1 and P2 may be identical to those shown in Fig. 4, but the intermediate panels P3 and P4 connected in series between the panels P1 and P2 are shown in Fig. 5 to have double pole double throw manual register switches 21″ and 21‴ so that regardless of which one of the switches 21, 21′, 21″ or 21‴ is operated, a complete circuit can be connected or disconnected through all of the corresponding lamps L21—L21‴ along a conductor 220 connecting these lamps in series from the common conductor 121 to the power supply unit P through cable 110. The other part of the circuit from the lamps L21—L21‴ is through switch 21′, one or the other of the

two conductors 221 or 222, a corresponding one of the two contacts of switch 21‴, one of the two conductors 223 or 224, a contact of switch 21″, one of the two conductors 225 or 226, one of the two contacts of switch 21 in the main panel P1, resistance R21 and conductor 227, contact 228 of the bi-stable units or paging relay U021, to the common return conductor 204 which connects the conductor 123 back again to the power supply unit P. Accordingly, for more than two panels an additional or a third wire or conductor 220 is necessary between each register which also may be used for only two panels, if desired.

IV. THE SELECTING CIRCUITS

Referring now to the circuits of Figs. 3 and 4, the selecting devices comprise on the keyboards three rows of ten keys each corresponding to the hundreds digits H, ten digits T and units digits U on the keyboard such as shown in Fig. 3 together with a cut-out relay CO; and in the control regster panel P1 shown in Fig. 4, one hundreds relay for each hundreds digits (herein three if 300 doctors or persons are to be registered on the panel) and two tens digits relays for each of the tens digits, namely T00–T29 and Ta00–Ta29. The hundreds and tens relays are each provided with ten contacts, or they each may comprise two relays in parallel with five contacts each whichever is more practical.

A. *Keyboard occupation*

In the inoperative position for a keyboard when no selection is being made, the three zero keys H0, T0 and U0 are pressed in or operated into the positions shown in Fig. 3. In this position the cut-out relay CO for that particular keyboard is deenergized, so that another one of the keyboards may be operated. If keyboard K1 is operated, the "in use" light on all the remaining keyboards will be lighted (see Figs. 2, 3 and 6) through a circuit from the positive pole 154 in the power supply unit P through conductors 169, 250, 251 in the keyboard circuit of Fig. 3 or Fig. 6, now closed front contact 252 of relay CO1 common conductor 253 (see also Fig. 6), then in parallel through conductors 254, 255 and 256, back contacts 257, 258 and 259 of cut-out relays CO2, CO3 and CO4, respectively, conductors 261, 262 and 263, protective resistances 264, 265 and 266, "in use"lamps LU2, LU3 and LU4, and conductors 267, 268 and 269, common conductor 270, back to the power supply P and conductor 158 to negative pole 153 of rectifier 150. Thus one keyboard may be operated at a time.

The operation of any one of the keys other than the zero keys in the hundreds, tens or units rows, H, T and U of any keyboard, causes the cut-out relay CO for that keyboard to operate which prepares the circuits for the operation of the hundreds and ten digits selecting relays in the control panel P1. The circuit for the operation of a cut-out relay, such as CO1, is from the positive pole 154 of rectifier 150, through resistance 166, conductors 169, 250, 271 (of keyboard K4), back contact 272, conductor 273, back contact 274 of cut-out relay CO3, conductor 275, back contact 276 of cut-out relay CO2, conductor 277, one or more of the contacts 278, 279 and 280 of keys HO, TO and UO, respectively, of keyboard K1 (all of which contacts are open when the zero keys in each of these rows are operated so that no current flows through them), conductor 281, cut-out relay CO1, conductors 282, 270, 158 to the negative pole 153 of the rectifier 150.

If only two keyboards are employed, both their circuits are the same as that shown in Fig. 3 except that in the second keyboard the interconnecting conductors 277 and 283 between them are interchanged with respect to the contacts to which they are connected. Thus when two or more keyboards are employed, they are interconnected through the contacts of their cut-out relays CO so that as soon as one of the keys in one of the digit rows on one of the keyboards is operated, the corresponding cut-out relay of that particular keyboard is operated and a circuit is completed so that the "in use" lights of all the other keyboards are automatically lit.

B. *Register selection*

For the purpose of illustration let it be assumed that the person or doctor having the number "49" (or 049) is to be selected to determine whether he is "in" or "out" in order to give him a message. There is no "000" numbered person because this corresponds to the inoperative and home position of the keyboards. Under these circumstances let it also be assumed that the keyboard K1 shown in Fig. 3 does not have its "in use" light LU1 illuminated, so that no other call is being selected on any other keyboard of the system, and the operator may operate this keyboard K1. Now the operator pushes the keys T4 and U9 and leaves key H0 untouched because it is already operated and in its home position. As soon as the keys T4 and/or U9 are pressed, the cut-out relay CO1 is correspondingly energized through the circuit previously traced, to connect potential from the power supply unit P to the conductors connected to the keys in the columns H, T and U. The hundreds relay H00 in the control panel P1 of Fig. 4 is now energized over the following circuit: from the positive terminal 154 of the rectifier 150 in the power supply unit P, through conductor 164 and resistance 166, conductors 169, 250, 284 (see Fig. 3) now closed front contact 285 of relay CO1, conductor 286, closed contact 287 of the key H0, conductor 288 in cables 104 and 105 to the panel P1, zero hundreds relay H00, conductors 289, back to common conductor 290 which is part of the cable 110 back to the power supply cabinet P and connects with the conductor 158 to the negative pole 153 of the rectifier 150. The energization of this hundreds relay H00 closes its ten contacts so that through the operation of the key T4, the two tens relays T04 and Ta04 are energized over the following circuits: from the positive terminal 154 in the power supply cabinet P through conductor 164, resistor 166, conductors 250 and 284 to the keyboard K1 in Fig. 3, and thence through the same closed contact 285 of relay CO1, conductors 286 and 291 now closed contacts 292 of key switch T4, conductor 293 through cables 104 and 105 to panel P1, now closed contact 294 of relay H00, conductors 295 and 296, relays Ta04 and relay T04 in parallel, conductors 297 and 298 which connect with the conductor 289 which in turn connects the conductor 290 back to the power supply unit P, conductor 158 to the negative terminal 153 of the rectifier 150. Now the desired selecting circuit relays H00, Ta04 and T04 are all energized closing all ten of each of their corresponding contacts.

The operation of units key U9, which is the unit digit of the person "049" to be selected, only prepares the circuit for connection to the desired person's registers and for the energization of the bi-stable units and paging relay U049, which relay is only energized by the operation of the message button M and deenergized by the reset button R described in Chapter VI later. However, by the operation of the key U9, the circuit is completed when the detecting push button D is operated to operate either the "in" or "out" light in the particular keyboard K1 shown in Fig. 3, depending upon whether or not the corresponding signal lights L49, L49′ at the registers for that person is illuminated or not to indicate whether that person is "in" or "out."

V. THE DETECTING CIRCUIT

After selecting keys H0, T4 and U9 have been pressed or operated to select the registers of person "49," then by pressing the D button on the keyboard it may be determined whether that selected register indicates that the person "49" is "in" or "out." If the person "49"

is "in," a circuit is completed on the operation of the D button simultaneously to operate the in-and-out relay IOR in power supply unit P and to illuminate the "in" light L1 of the corresponding keyboard.

This circuit is completed to energize the in-and-out A. C. relay IOR when button D is held operated, from one terminal of the transformer TR1, conductors 122 and 300, relay IOR, conductor 301 through cables 103 and 104 to the keyboard K1, conductor 302, through the normally closed contacts 303 of check button switch C, conductor 304, now closed contacts 305 of detecting button switch D, conductors 306 and 307, front contacts 308 of the cut-out switch CO1, conductors 309 and 310, now closed contacts 311 of key switch U9, conductors 312 and 313 to the panel P1, conductor 314, now closed contacts 315 of relay T*a*04, conductors 316, lighted signal light L49 (because of less resistance than through resistance R49), manual switch 49, conductors 201 and 121 back to the other terminal transformer TR1.

The "in" light L1 is lit through the following circuit: A. C. potential from the center tap 130 of the transformer TR2 through conductor 320 to the keyboard K1, conductor 321 to now closed contacts 322 of the cut-out relay CO1, conductor 323 along the units row U of the keys through now closed contacts 324 of key U9, conductors 325, 326, 327, now closed contacts 328 of key T4, conductors 329 and 330, now closed contacts 331 of key H0, conductors 332 and 333, now closed contacts 334 of detecting button switch D (which is only held closed sufficiently long to illuminate the keyboard light L1), conductors 335, 336 and 337, "in" light L1, conductors 338 and 340 back to power supply unit P, now closed contacts 341 of the in-and-out A. C. relay IOR, conductors 342, 343, 132 and 133 to an end terminal of the transformer TR2. Now the "in" light L1 of the keyboard in Fig. 3 is illuminated to indicate that the person having the number "49" has operated his manual switch 49 on one of the panels and his corresponding signal lights L49, L49', etc., are lighted.

If the lights L49, L49', etc. are not lit and the person "49" is "out," then in-an-out relay IOR would not be energized because the circuit through it instead of being through the light L49, would be from conductor 316 in the panel P1 through the resistance R49 of the register, conductor 202, contacts 203 of units paging relay U049, conductor 204, back again to conductor 122 to the same terminal of the transformer TR1, so that the relay IOR would be shunted out and not energized and remain in the position shown in Fig. 2. Then the following circuit would be completed for illuminating the "out" light LO over the following circuit when the push button D was pressed: from the center tap 130 of the transformer TR2, conductors 320, 321, contacts 322 of relay CO1, conductor 323, contact 324 of key U9, conductors 325, 326, 327, contacts 328 of key T4, conductors 329, 330, contacts 331 of key H0, conductors 332, 333, contacts 334 of switch D, conductors 335, 336 and 344, through "out" light LO, conductors 345 and 350 back to the power supply unit P, back contacts 341 of in-and-out relay IOR, conductors 342, 343, 132 and 133 to the end terminal of the transformer TR2. Thus, depending upon whether the circuit for energizing the in-and-out relay IOR in the power supply unit P in Fig. 2 is energized by the operation of one of the manual register switches 49 and a corresponding indicating lamp L49, determines which circuit will be set up through the contacts 341 of that relay IOR for energizing corresponding "in" or "out" light LI or LO on the keyboard.

In order to prevent the "in" and "out" lights LI and LO on the keyboard from flashing when detector switch D is operated and a corresponding paging units relay is energized, so that flashing current from conductor 123 is connected through contacts 203, conductor 202 and resistance R49 to conductor 316 described later, an anti-flashing relay AR may be provided in the power supply unit P, which relay AR may be energized during the time the detecting switch D is held operated to shunt out the interrupter contacts 129 and continuously energize both the interrupter relays IR1 and IR2, so that only a contact voltage will be applied to either the "in" or "out" lights as long as the detector switch D is manually pressed down. This does not materially affect any of the paging messages which may be set up at this time, in that the operation of the button D is generally very short, only being held down long enough to see which one of the two lights LI or LO is lighted, and then it is released since there is no purpose for maintaining the button D pressed for any longer length of time. Thus any paging or flashing signal will only be momentarily interrupted and practically the interruption can hardly be detected. The energization of the anti-flashing relay AR is thus from central tap 130 of transformer TR2 through conductors 320, 321, contacts 322, conductors 323, contact 324 of key U9, conductors 325, 326, 327, contacts 328 of key T4, conductors 329, 330, contacts 331 of key H0, conductors 332, 333, contacts 334 of switch D, conductors 335, 351, 355, anti-flashing relay AR, conductors 356, 132 and 133 to an end terminal of transformer TR2. This operation of relay AR, only during operation of button D, shunts or shorts the interrupter contact 129 through a circuit of conductor 357 connected to tap 130, now closed contacts 358 of the relay AR, and conductor 359 which is connected to the conductor 131 connected directly to the interrupter relays IR1 and IR2.

Similarly, a selecting circuit for each one of the other persons listed on the panels may be set up by punching the corresponding digit keys of the number of that person on a keyboard. If more than one panel is employed, the circuits for the signal lights and the manual register switches are traced in series through them as previously described in Chapter III above and Figs. 4 and 5 relating to the register circuits themselves.

VI. THE PAGING CIRCUIT

A. *Set-up*

If it is desired to page the person corresponding to the selected number "049" when, for instance, there is a call for that person at the main office or a letter or message to be picked up by him, then the register signal lights L49, L49', etc. corresponding to this person at the panels can be caused to intermittently flash if they are on and the person is in the region or hospital, or to flash as soon as the person enters the region or hospital and operates his corresponding manual register switch 49 on one of the register panels. In order to set up this flashing signal, which may be replaced by a buzzer or any other type of electrical signalling device, a selection of the person "049" is set-up on a keyboard, and then the message or paging button M is pressed or operated and released.

This instantaneous pressing of the message button M after selection of the desired registers causes the unit paging relay U–049 in the control panel P1 to be energized and move its contacts 203 into the position other than that shown in the drawings. The circuit for the energization of relay U–049 is as follows: a positive potential from the terminal 154, through conductor 164, part of resistance 156 to tap 157, conductors 159, 400 in cables 103 and 104 to keyboard shown in Fig. 3, conductor 401, now closed contacts 402 of the cut off relay CO1, conductor 403, now closed contacts 404 of the message switch M, conductor 405, normally closed contacts 406 of the detecting switch D, conductor 407, now closed contacts 408 of the cut-out relay CO1, conductors 409, switch 410 of the now closed units selection key U9, conductor 411 in cables 104 and 105 to the control register panel P1 shown in Fig. 4, conductors 412 and 413 through bi-stable units paging relay U–049 to ener-

gize this relay to operate its contact 203, conductor 415, now closed contacts 416 of the corresponding tens digit relay T–04, conductors 417, 298, 297 and 290 in cable 110 back to the power supply unit P, and conductor 158 to the negative terminal 153 of the rectifier 150.

Operation of the contacts 203 of the bi-stable units relay U–049 changes the potential for lighting the signal lights L49, L49', etc. of all the panels from a steady or continuous A. C. voltage source via supply conductors 121 and 122 to an intermittent voltage source via conductors 121 and 123, produced by the operation of the interrupting relays IR1 and IR2 previously described in the operation of the power supply circuit unit in Fig. 2 in Chapter II above. The remaining part of the circuit for energizing the lights L49, L49', etc. is the same as that described and traced in Chapter III relating to the register circuit.

B. *Release*

When the doctor or person has responded to his paging signal by calling at a station of any one of the keyboards for the message for which he was paged, his paging, or the flashing of his signal light should be cancelled. This cancellation or releasing of the paging signal is accomplished by again setting up the selection for that person by operating his corresponding numbered selecting keys on a keyboard, namely keys H0, T4 and U49, after which the reset switch button R on that keyboard is operated and released. This instantaneous operation of the reset switch button R applies on opposite charge of direct current to the bi-stable relay U–049 from the condenser 170 provided in the power supply unit of Fig. 2 to dislodge contacts 203 from their flashing connection position and move them again into the position shown in Fig. 4. These particular unit paging relays U–001 through U–300 or more are each of the bi-stable type, so that once they are energized or deenergized their corresponding contacts remain in that corresponding position whether or not the current thereafter is cut off or not, and it takes an opposite surge of current through the relay to move the contacts into the other position. Such bi-stable relays may have special residual magnetism characteristics, and/or may be relays with spring applied armatures.

Before effective operation of the reset button R can be obtained, it is necessary that the condenser 170 in series with the variable resistor 171 is charged as soon as a keyboard has been selected or its cut-off relay CO has been energized. The resistance 171 is made variable to control the amount of discharge current from the condenser 170 so that there will be no tendency of the bi-stable unit relay to reset again into its flashing position at the register panel P1, when the reset button R is pushed. If this is the case, the resistance 171 should be increased.

The charging of condenser 170 is through the following circuit: from the positive terminal 154, through conductor 164, part of resistance 156 to tap 157, conductors 159, 400 and 401, now closed contacts 402 of relay CO1, conductors 403 and 420, normally closed contacts 421 of the reset switch button R, through conductors 422 and 423 in cables 104 and 103 to the tap of resistance 171 and to the one plate of condenser 170 (which in this particular instance may be an 8 microfarad condenser), which plate correspondingly is charged positively so that the other and opposite plate thereof will be charged negatively. This negatively charged plate is connected through conductor 424 in cables 103 and 104 to keyboard of Fig. 2, conductor 425, now still and normally closed contact 426 of the reset switch button R, conductor 427, now closed contacts 428 of the cut out relay CO1, conductors 429 and 270 through cables 104 and 103, and conductor 158, to the negative pole 153 of the rectifier 150. The condenser 170 is thus charged so that a positive potential is connected to conductor 423 and a negative potential to the conductor 424.

Now with the operation of the reset switch push button R, the potential from these two plates of the condenser 170 are applied in the opposite direction across the selected bi-stable units paging relay U–049 from that required to energize the relay described in Chapter VI—A above, to reverse the operation of this relay according to the following circuit: positive potential from the plate of condenser 170 through part of resistance 171, conductors 423, 422, now closed contacts 421 of button R, conductors 431 and 427, contacts 428 of relay CO1, conductors 429, 270, 290 in cable 110 to panel P1, 289, 297, 298, 417, contacts 416 of relay T–04, conductor 415, paging relay U–049, conductors 413, 412, 411 in cables 105 and 104 to the keyboard in Fig. 3, contacts 410 of key U–9, conductor 409, contacts 408 of relay CO1, conductors 407, contacts 406 of button D, conductor 405, contacts 404 of button M, conductor 432, now closed contacts 426 of reset button R, conductors 425 and 424 in cables 104 and 103 to power supply unit P, to the negative plate of condenser 170. This reverse circuit discharges the condenser 170 through the paging relay U–049 causing it to reset into its shown position. Thus, the armature carrying the ocntacts 203 of the units paging relay U–049 is moved back into the position shown in Fig. 4, so that the current through the signal lights L49, L49', etc. is now continuous, and the flashing signal is removed.

In view of the bistable properties of the relay U–049, it will maintain the position in which it is set either by the message paging button M or by the reset button R, regardless of whether or not the signal lights L49, L49', etc. are burning or not, so that if a person is not in the region a connection can be set up so that this lamp will start to flash immediately as he operates his corresponding registering switch on a register panel, to indicate that a message is already awaiting him. As soon as the reset switch R on the keyboard is released, the condenser 170 is again charged according to the circuit described above before the button R was pressed in preparation for the next resetting operation.

VII. THE MESSAGE CHECKING CIRCUIT

Referring to Fig. 3 there is an additional push-button C on each of the keyboards which is normally maintained in the position shown, such as by means of a spring S as shown beneath each of the buttons D, M, R and C on each keyboard. If this button C is pressed by an operator after a selection has been set up for a given person's registers, it may be determined whether or not a paging message has been requested for that person at his registers, that is, whether or not a circuit has been set up to cause the signal lights at that person's registers to flash or are flashing. If flashing has been set up, the "check" lamp LC shown on that particular keyboard also will flash, otherwise it will stay lit steadily as long as the button C is pressed. This feature has the advantage, when multiple keyboards are employed in a system, to determine if an operator of another keyboard has already set up a paging message for a given person, or if a message which has been set up at one keyboard has been answered at another keyboard and therefore has been cancelled by that other keyboard.

For the purpose of illustration let us assume that the same person or number is selected, namely person "049", and the corresponding keys on the keyboard K1 in Fig. 3 are operated in the previously described circuits. Now, if it is wished to determine whether or not a call or paging message has been set up for this particular person, by this or any keyboard, then only the push button switch C is operated which switch completes circuits for operating simultaneously the check relay CR in Fig. 2 and the check light LC.

The check relay CR in the control and power supply unit P in Fig. 2 is energized when check switch button C is pressed via the following circuit: from conductor 121

from one terminal of the secondary transformer TR1 through conductor 450, check relay CR, and conductor 451 in cables 103 and 104 to the keyboard K1 of Fig. 3, conductor 452, now closed contacts 453 of check switch button C, conductor 454, now closed contacts 305 of button D, conductor 307, now closed contact 308 of cut-out relay CO1, conductors 309 and 310, now closed contact 311 of key U9, conductors 312 and 313 in cables 104 and 105 to the panel P1 in Fig. 4, conductor 314, now closed contacts 315 of auxiliary tens relay Ta04, conductor 316, resistance R49, conductor 202, to contact 203 of paging relay U–049, to either the continuous conductor 204 which connects through cable 110 to the continuous voltage conductor 122 or to the flashing or intermittent voltage conductor 123 back to the other terminal of transformer TR1, causing the checking relay CR to either be continuously energized or intermittently energized, respectively, and so to operate its contacts 452 in the circuit of the "check" light LC causing it, respectively, to be steadily lit or flashed. Thus the operation of the checking relay CR depends upon the operation of the paging relay contacts 203 in the register through which the checking relay CR is either continuously or intermittently energized.

Let us assume first that a continuous voltage is applied to lights L49, L49', etc. and that no message has been given to the person corresponding to the switch 49 on the panel, then the following circuit will be completed to continuously light the "check" light LC as long as the push button C remains manually pressed; from the central tap 130 on transformer TR2 of the power supply circuit of Fig. 2 through conductor 320 in cables 103 and 104 to keyboard K1 shown in Fig. 3, conductor 321, now closed contacts 322 of cut-out relay CO1, conductor 323, now closed contact 324 of key U9, conductors 325, 326 and 327, now closed contacts 328 of key T4, conductors 329 and 330, now closed contacts 331 of key H0, conductors 332, 333, normally closed contacts 334 of detecting switch D, conductor 461 to now closed contacts 462 of the check switch button C, conductor 464, check light LC, conductors 465 and 466 in cables 104 and 103 to the power supply unit P, contacts 452 of relay CR, conductors 468, 343, 132 and 133 back to one terminal of the transformer relay TR2. Check light LC now remains continuously lit as long as check button C is operated.

On the other hand, if a paging signal has been set up for the person "049" on his corresponding registers, then the energization of checking relay CR is intermittently energized, thus alternately opening and closing its contacts 452 corresponding to the operation of interrupter relays IR1 and IR2, which causes the "check" light LC to flash according to the above last traced circuit through said contacts 452.

VIII. SUMMARY

Some of the important distinctions of the circuit of this invention over that of the above mentioned co-pending application of Slocum et al., Serial No. 229,938, now U. S. Patent No. 2,682,654, issued June 29, 1954, are that (1) the "in" and "out" detecting circuits are controlled from an A. C. voltage source instead of a D. C. voltage source; (2) the addition of a message check button C and its "check" light LC to determine whether or not a message has been placed on a given person's registers; (3) the addition of a cut-out relay and an "in use" lamp in each keyboard so that a plurality of keyboards may be employed without the operation of one interfering with that of another; (4) the employment of a plurality of registered panels all of which operate in unison or alike and which may be located in different places throughout the region or building in which the system is installed; (5) ten more wires are required from the keyboards to the control register panel; and (6) an additional or auxiliary tens relay or ten more contacts for each digital tens relay on the control register panel are also required.

The present improved system of this invention is adaptable for either a plurality of keyboards and one register panel, a plurality of register panels and one keyboard, or both a plurality of register panels and a plurality keyboards.

While there is described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of this invention.

What is claimed is:

1. A register and paging system comprising: register panels having a plurality of separate registers thereon, a plurality of keyboards, separate indicating means in each register on each panel for each person to be paged, means on each keyboard for selecting a given register on said panels corresponding to a digital number set-up on said keyboard, means for locking out all but one keyboard on which a selection is being made, means for maintaining the paging of a plurality of persons on said panels simultaneously until each registered person being paged on his corresponding register is individually released by an operation at one of said keyboards, and means at each of said keyboards for checking whether a given register on said panels is operating for paging.

2. A register and paging system comprising: at least one register panel having a plurality of separate registers for each person to be paged, each register comprising a paging signalling device, selective means at said one panel for individually selecting one of said registers responsive to a plural digit number transmitted thereto, at least one one keyboard remote from said panel, means on said keyboard for transmitting a plural digit number to said selective means for connecting a correspondingly numbered one of said registers to said keyboard, and a plurality of circuits each including connections of said selective means, said circuits comprising a first circuit means including a paging switch at said keyboard for operating said paging signalling device in said numbered one of said registers, a second circuit means including means including a releasing switch at said keyboard to prevent said signalling device from operating, and a third circuit means including a check switch and indicating means at said keyboard for indicating whether said signalling device at said register is operating.

3. A system according to claim 2 including more than one keyboard and means associated with each keyboard for locking out all but the one keyboard on which a selection is being made.

4. A system according to claim 3 including indicating means on each keyboard to indicate when one of the other keyboards is making a selection.

5. A system according to claim 3 wherein said means for locking out one keyboard includes a cut-out relay having contacts in the circuits of said selecting means.

6. A system according to claim 2 wherein said first circuit means includes a bi-stable D. C. relay and a D. C. voltage source connected through said paging switch to said relay.

7. A system according to claim 6 wherein said second circuit means includes a condenser, means for charging said condenser, and means including said releasing switch for discharging said condenser through said bi-stable relay to release said relay.

8. A system according to claim 2 wherein said third circuit means includes a relay and means for energizing said relay in accordance with the operation of said signalling device for controlling the operation of said indicating means.

9. An in-and-out registering and paging system comprising: at least one register panel having a plurality of separate registers thereon for each person to be registered and paged, each register comprising a signalling device

and a manually operated switch for operating said signalling device to indicate the "in" and "out" conditions of that person corresponding to that register, selective means at one of said register panels for individually selecting one of said registers responsive to a plural digit number transmitted thereto, at least one keyboard remote from said panel, means on said keyboard for transmitting plural digit numbers one at a time to said selective means for connecting a correspondingly numbered and selected one of said registers to said keyboard, and a plurality of circuits each including connections of said selective means comprising a first circuit means including a detecting switch and "in" and "out" indicating means at said keyboard for indicating the "in" and "out" conditions controlled by said manually operated switch at said selected register, a second circuit means including a paging switch at said keyboard and a paging device at each register on one of said panels, said paging switch operating the paging device of said selected register to connect a paging signal to said signalling device of said selected register, a third circuit means including a releasing switch at said keyboard to operate said selected paging device to disconnect the paging signal from said signalling device, and fourth circuit means including a check switch and an additional indicating means at said keyboard for indicating how said paging device at said selected register is operated.

10. A system according to claim 9 including two register panels and at least two conductors connecting each corresponding register between said two panels.

11. A system according to claim 9 including more than two register panels and three conductors connected between each corresponding register of each of said panels, one of said conductors connecting all of said signalling devices of any one numbered register on all said panels in series.

12. A system according to claim 2 wherein each said signalling devices comprises an electric light, and said paging device in said first circuit means includes means for flashing said electric light.

13. A system according to claim 12 wherein said means for flashing said signalling devices includes a mechanical circuit interrupting device.

14. A system according to claim 12 wherein said indicating means in said third circuit means includes an electric light and means for flashing said electric light according to the operation of said selected paging device.

15. A system according to claim 12 including means associated with said first circuit means for preventing the flashing of said "in" and "out" indicating means.

16. A system according to claim 15 wherein said means for preventing flashing includes a relay and a circuit for shunting out said flashing means.

17. A register and paging system comprising: register panels having a plurality of separate registers thereon, a plurality of keyboards, separate indicating means in each register on each panel for each person to be paged, means on each keyboard for selecting a given register on said panels corresponding to a digital number set up on said keyboard, means at each register to produce a register indication on said indicating means, means at each keyboard for effecting the indicating means at selected registers for paging, means for locking out all but one keyboard on which a selection is being made, means for maintaining the paging of a plurality of persons on said panel simultaneously until each registered person being paged on his corresponding registers is individually released by an operation at one of said keyboards, and means at each keyboard for checking whether said indicating means at a given one of said registers is operating for paging.

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