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This application Apr. 26, 1968, Ser. No. 724,388

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[54] MULTIPLE STATION INTERCOMMUNICATIONS
SYSTEM
12 Claims, 7 Drawing Figs.

[52] U.S. Cl. 340/286, 340/151, 340/153, 340/413
[51] Int. Cl. G08b 5/00, H04q 3/00
[50] Field of Search 340/332, 311, 23, 309.4, 309.5, 286, 151, 153, 147, 176, 171, 276, 287, 288, 413, 213 K, 318

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ABSTRACT: A system interconnecting several stations, each having one of two conditions which it is desired to communicate to all stations so that the conditions of all stations is indicated at each station. A plurality of indicators, one for each station, are at each station, and have an energized and deenergized state for indicating the conditions of the corresponding stations. Silicon controlled rectifiers maintain the energized condition of energized indicators. Each station is sequentially scanned in response to a change in condition of any one of the stations.

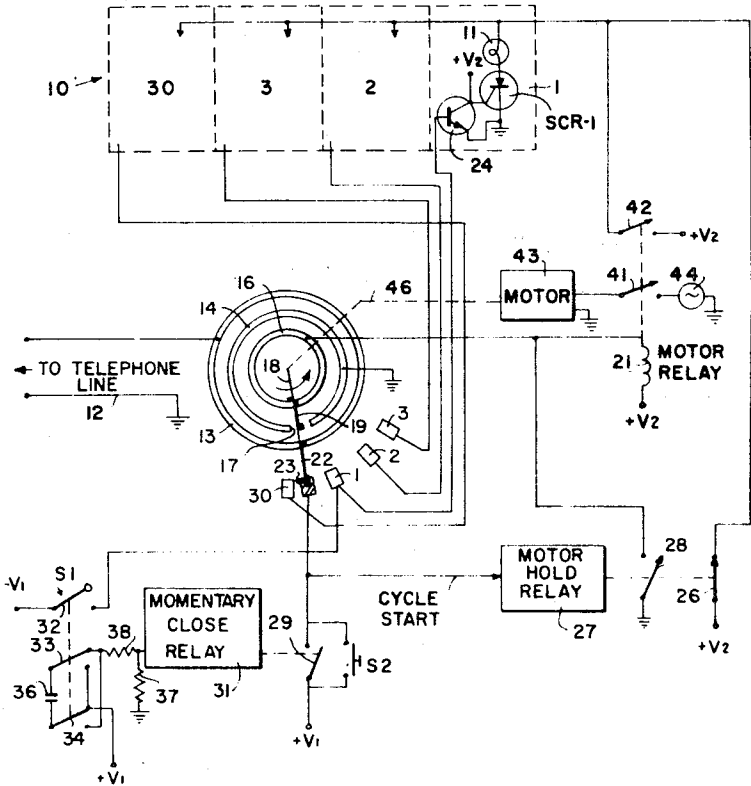


FIG. 1.

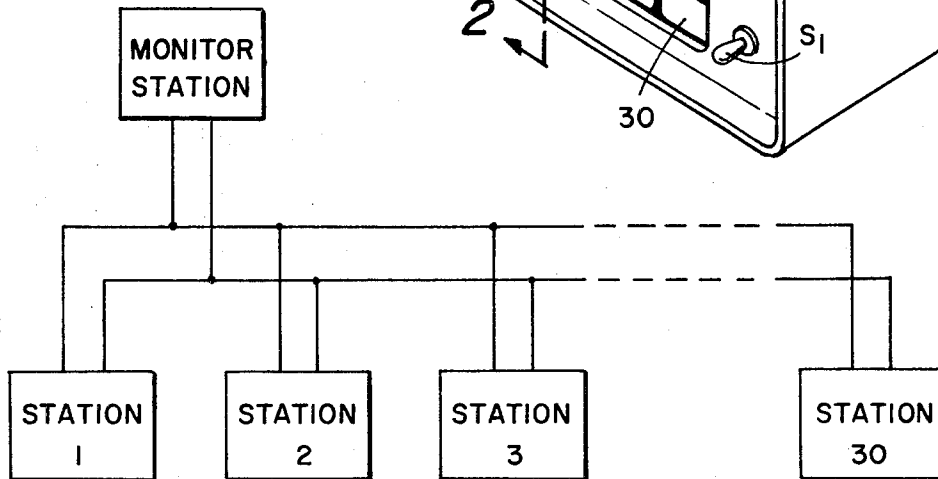
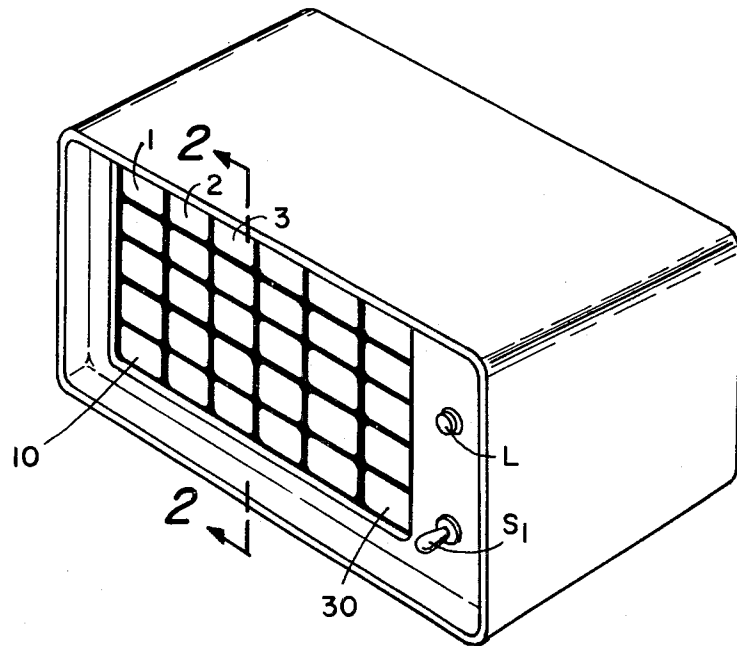


FIG. 3.

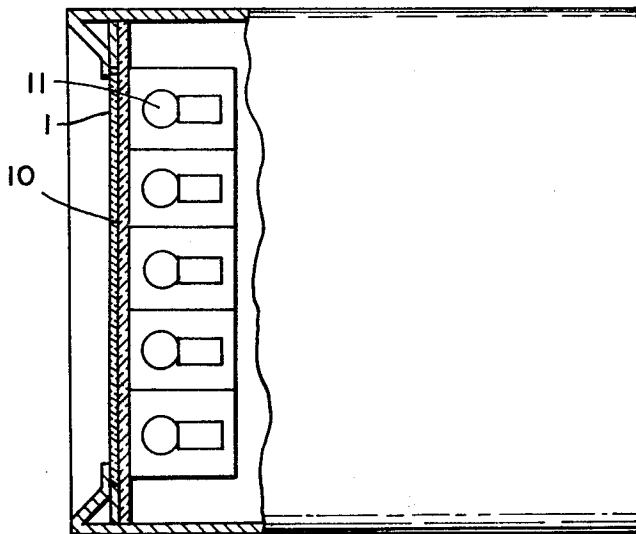


FIG. 2.

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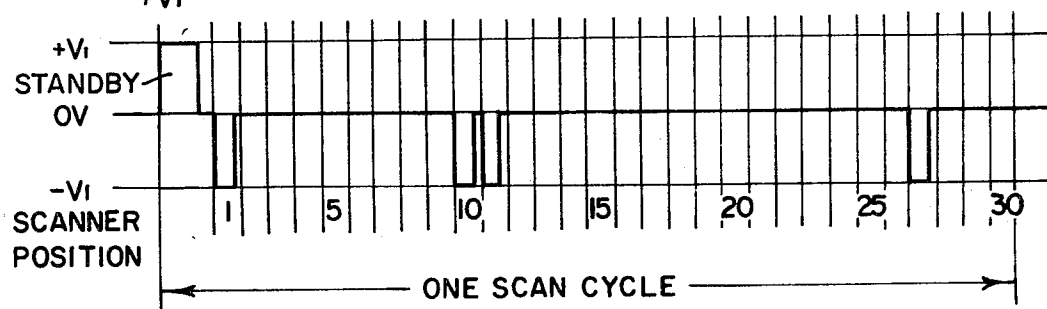
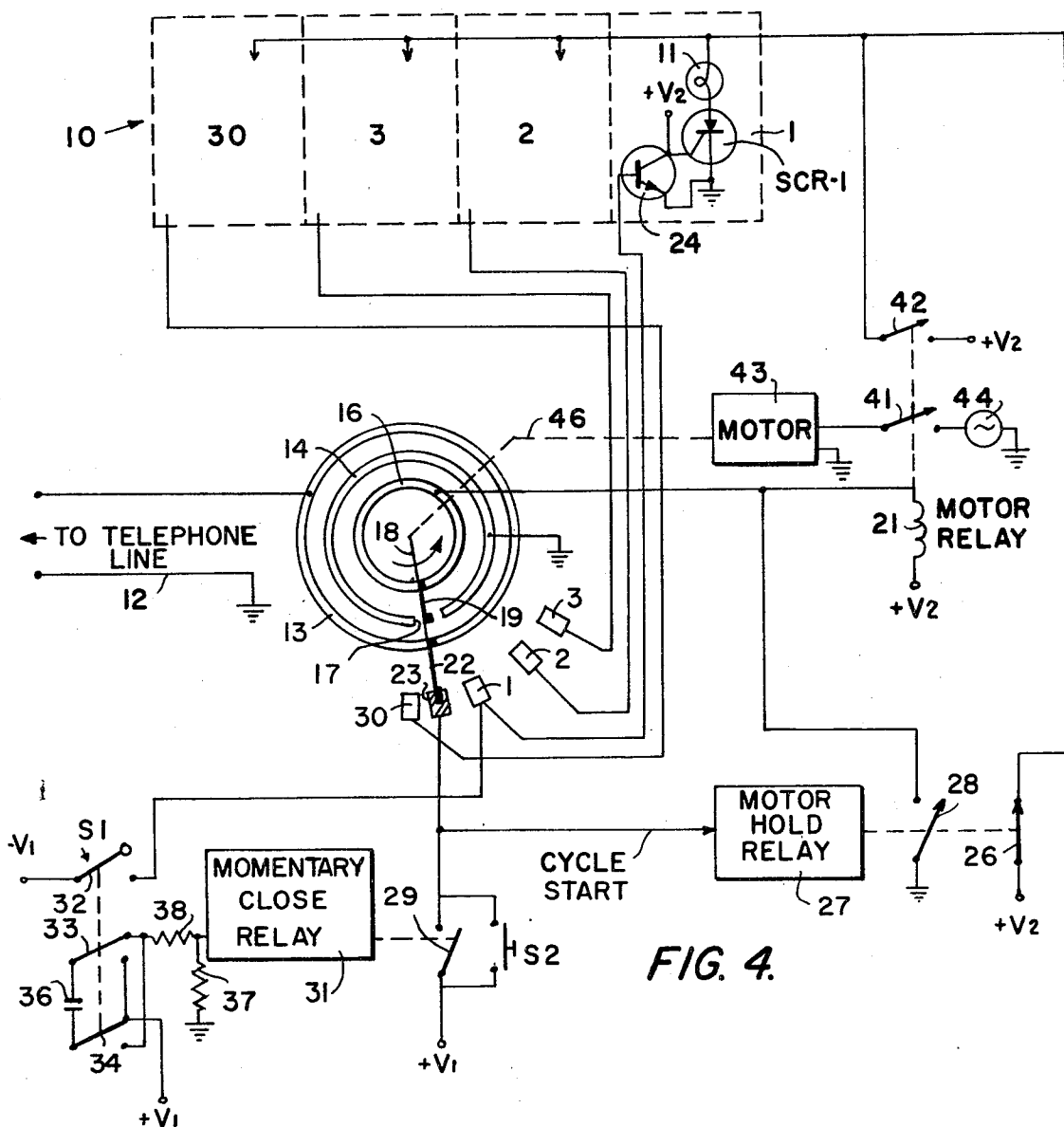
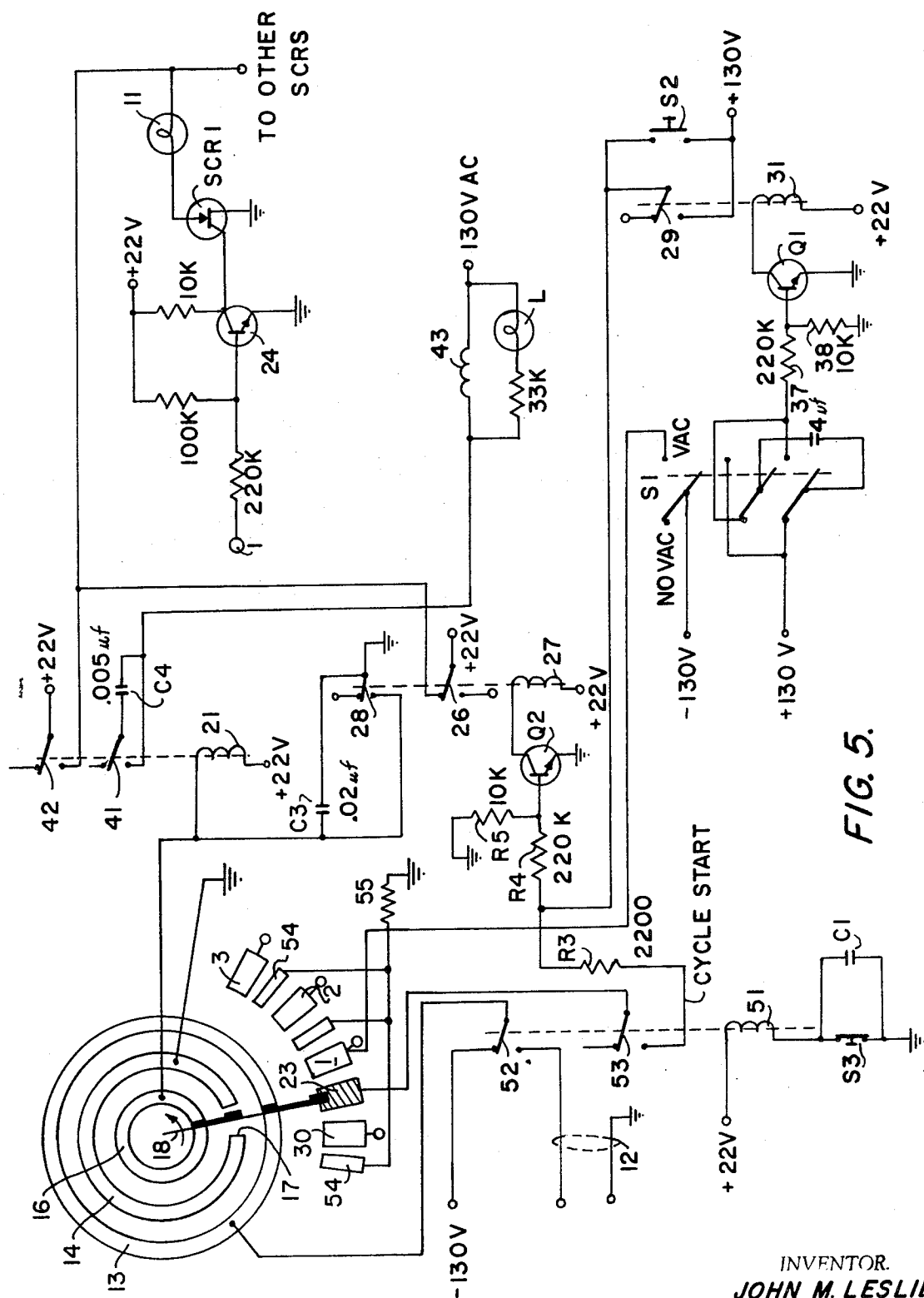


FIG. 6.

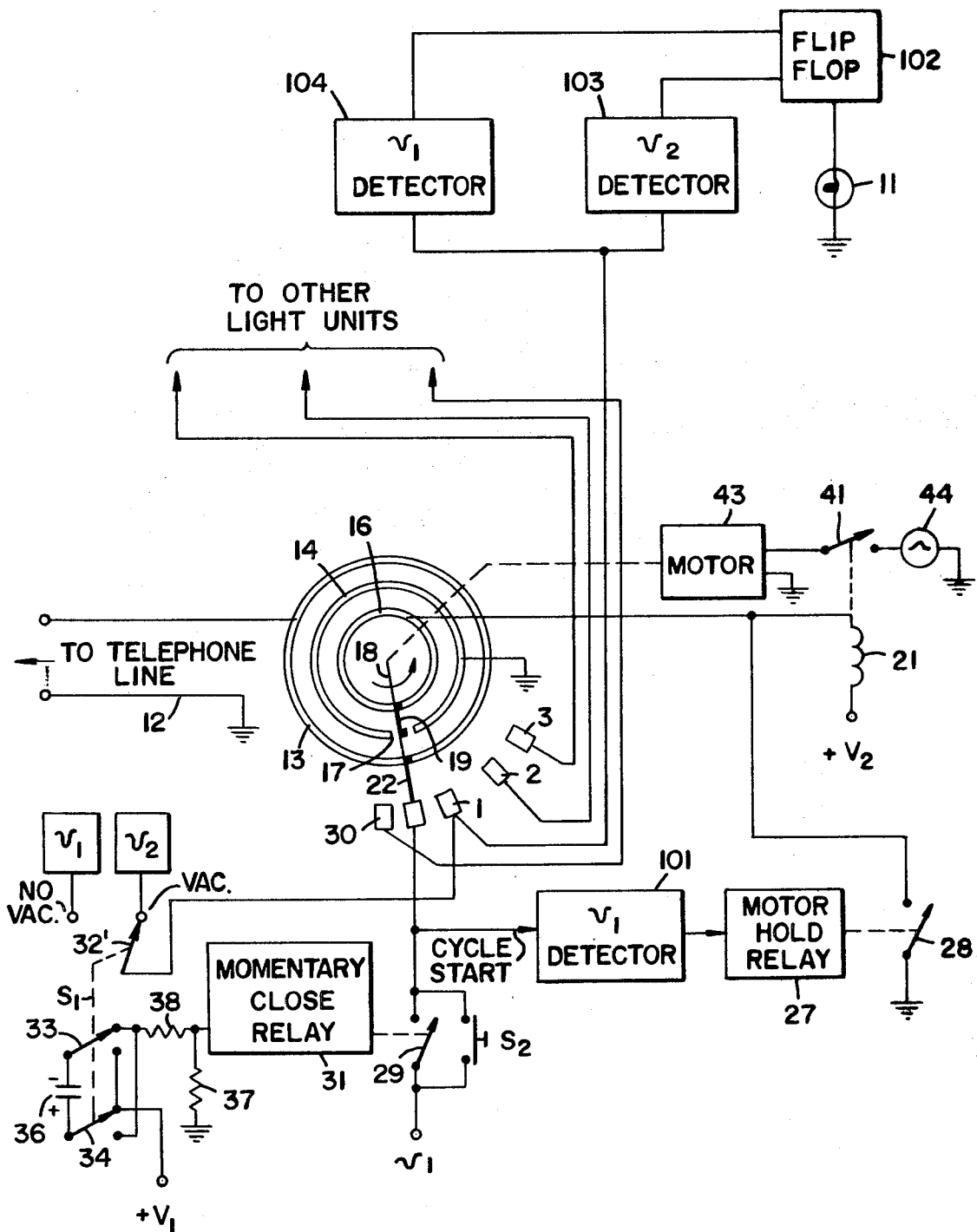
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FIG_7

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MULTIPLE STATION INTERCOMMUNICATIONS SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of copending application Ser. No. 624,008, now abandoned, filed Mar. 17, 1967, in the name of John M. Leslie, and entitled Multiple Station Intercommunications System.

BACKGROUND OF THE INVENTION

The present invention is directed to a multiple station intercommunications system and more specifically to a system which indicates one of the two conditions of several stations.

In the hotel or motel industry it is desired to know the vacancy status of other local hotels or motels. This is either for the purpose of referring prospective guests at an establishment which has no vacancy to an establishment which has a vacancy or for the general public which is seeking a vacancy at some hotel or motel.

OBJECTS AND SUMMARY OF INVENTION

It is a general object of the present invention to provide an improved multiple station intercommunications system which, for example, may contact several different hotels for the purpose of indicating whether or not each of the hotels has a vacancy.

It is another object of the invention to provide a system in which such information is continuously available.

It is another object of the invention to provide an improved system in which the effects of noise on a telephone line pair interconnecting the stations are minimized.

It is another object of the invention to provide a system as above in which communication between stations is accomplished by either AC- or DC-type signals.

In accordance with the above objects there is provided multiple station intercommunications system where each station may be placed in either a first or second condition. Each station includes visual display means which indicates the conditions of all stations. The improvement of the invention comprises a plurality of visual display means at each of the stations, one corresponding to each station. A plurality of bistable means is included in each station, each of the bistable means corresponding to an individual station and coupled to a corresponding visual display. Each of the bistable means is responsive to the conditions of its corresponding station to control the display means. Thus each station provides a simultaneous display of the condition of all stations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one of the stations in the system of the present invention;

FIG. 2 is a partial cross-sectional view taken along the line 2-2 of FIG. 1.

FIG. 3 is a block diagram showing the overall system of the present invention;

FIG. 4 is a simplified schematic diagram of one of the stations of the system;

FIG. 5 is a more detailed schematic of FIG. 4 showing additional features of the invention;

FIG. 6 is a waveform showing typical voltages which would be present in the system; and

FIG. 7 is a simplified schematic diagram of an alternative embodiment of one of the stations of the system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 through 3, a single station of the system is indicated in FIG. 1 which has a visual display means 10 divided into 30 sections labeled 1-30. Each of these sections is illuminated from the rear by a light source 11. Moreover, each section is associated with a particular station of the system. The stations are most commonly placed in respective hotels or motels in order to indicate the vacancy

status of the hotel. In each section of the visual display means is a name or number of the particular hotel or station associated with that display section. This is normally provided by an overlaid mask. An "on" or illuminated condition of the section indicates a vacancy in that hotel and lack of illumination, no vacancy.

The particular details of the face of visual display means 10 are disclosed in a copending application Ser. No. 624,005, now abandoned, Mar. 17, 1967, in the name of John M. Leslie entitled "Monitor and Display Station" and assigned to the present assignee.

On the front panel of the station shown in FIG. 1 is a switch S1 along with a cycle indicating light, L. Switch S1 may be operated in an up position shown a vacancy and a down position to show no vacancy. Thus, for example, movement of the switch S1 to the vacancy position will cause one of the lights 11 which is associated with that particular station to be illuminated; for example, section 1. This vacancy information, as described in greater detail below, will also be simultaneously transmitted to the remaining stations of the system.

FIG. 3 illustrates the overall system where 30 possible stations are indicated. They are interconnected by a two wire line which is provided by the telephone company. In addition to the active stations 1-30, monitor stations may also be provided to indicate the vacancy or no vacancy condition of all of the other stations. However, the monitor station would have no vacancy switch S1.

FIG. 4 is a block diagram of the station of FIG. 1 where it is assumed that the station represents section of the visual display means which is indicated in a dashed block; typical station sections 2, 3 and 30 are also shown. A pair of conductors 12 which are coupled to the telephone line are indicated as terminating on a rotary switch selector which has conductive bands 13, 14 and 16. Band 14 is broken at point 17 where a moving commutator arm 18 is shown in standby position. Commutator arm 18 rotates in a counter clockwise direction and carries two pairs of brushes. A first pair 19 couples band 16 to band 14 which energizes a motor relay 21 by grounding one terminal through band 14 whereby current flows form a voltage source, $+V_2$. The other pair of brushes 22 of arm 18, couples the outer band 13 successively to peripheral segment 23 and additional segments labeled 1, 2, 3 and 30. These represent a total of 30 segments each of which is associated with a particular visual display section 1 through 30.

More specifically, as illustrated, segment 1 is coupled to visual display section 1 through a transistor 24 and a silicon controlled rectifier SCR-1. The anode of the rectifier is coupled to light source 11 which is illuminated by the triggering of the SCR. Voltage is supplied to the SCR through the light source 11 from a positive voltage source, $+V_2$, through a switch 26. The remaining segments 2 through 30 are coupled to the other display sections in a similar manner.

When the commutator arm 18 is contacting segment 23, it is in its rest or standby position. In this condition segment 23 is directly connected to the telephone line through conductor 12 and band 13. The segment 23 is coupled to a motor hold relay 27 having switch 26 which as mentioned previously supplies anode voltage to the SCRs of the visual display means 10 and also having a ganged switch 28 which has one terminal grounded and the other coupled to motor relay 21. Closure of switch 28 thus will energize the motor relay.

Segment 23 is also coupled to a, $+V_1$, voltage source through two alternative parallel paths; viz, a first path through push button switch S2 and a second through switch 29 which is actuated by a momentary close relay 31. Actuating means for this relay is switch S1 which, as discussed in relation to FIG. 1, is the vacancy-no vacancy switch. The respective positions of the switch are indicated. S1 consists of three ganged switches 32, 33 and 34. Switch 32 couples a negative voltage source, $-V_1$, when the switch is placed in its vacancy position, to the segment on the commutator ring which is associated with that particular station; in the present example this is station 1. The negative voltage turns off transistor 24, which is

normally in a saturated condition, to allow SCR-1 to be fired. This will be discussed in greater detail in conjunction with the detailed schematic of FIG. 5.

Switches 33 and 34 provide an energizing voltage to close relay 31 from a positive voltage source, $+V_1$, when switch S1 is moved from either a vacancy or no vacancy position to the other position. A current will flow through capacitor 36 from $+V_1$ to the ground connection through resistors 37 and 38. When the capacitor is fully charged the relay is in an open condition. For example, in the position shown, which is a no vacancy position, capacitor 36 is now charged to the plus-minus voltage indicated. No current is flowing through resistor 37 or the series connected resistor 38. However, when the switch was initially placed in this condition, the initial flow produced a closing of relay 31 until capacitor 36 was charged. When switch S1 is moved to its vacancy position, the charged capacitor 36 will discharge in the same manner through resistors 38 and 37 to ground, again causing relay 31 to close.

The line to motor hold relay 27 from segment 23 is labeled "cycle start" since by means of a $+V_1$ voltage pulse either from the interconnecting telephone line or from the switches S1 or S2 a cycle start pulse will be given to motor hold relay 27.

Motor relay 21 controls ganged switches 41 and 42, switch 41 being coupled to a motor 43 and supplying from a suitable AC voltage source 44 the energizing voltage for the motor. The output shaft 46 of the motor is coupled to rotating commutator arm 18. Switch 42 has one terminal coupled to a $+V_2$ voltage source and provides an alternate anode voltage supply for the SCRs of visual display 10.

OPERATION

FIG. 6 illustrates the different voltages which will appear on line 12 during a typical scan cycle of the system of the present invention. For the case where no hotel or station of the system has a vacancy, switch S1 will be in the no vacancy position as it is now shown. Thus all of the transistors 24 of the visual display means will be in a saturated condition clamping the trigger input terminal of the SCRs to ground. Therefore, no light sources 11 will be energized. If the scan cycle button S2, is pressed, motor hold relay 27 will be energized, energizing motor relay 21 to start motor 43. When commutator brush pair 19 engages band 14 the motor will hold itself on through the completion of its scan cycle. Therefore, segment 23 must be wide enough to assure voltage to relay 27 until contact is made with band 14. However, since no other stations have actuated their vacancy switch S1, no negative voltage, $-V_1$, will appear on any of the segments 1 through 30 to actuate the SCR associated with that station. At the start of the scan cycle, the pressing of the button S2 will merely produce a $+V_1$ cycle start pulse on the output line 12 (see FIG. 6) which will actuate the scanning motors of all of the interconnected stations. The scan cycle is completed when commutator arm 18 again reaches the standby position.

Assuming now, however, that switch S1 of station 1 as shown in FIG. 4 is actuated to its vacancy position, a, $-V_1$, voltage will be impressed on segment 1. The charged capacitor 36 will discharge through resistors 37 and 38 and close momentary close relay 31 closing switch 29 and applying a cycle start voltage to the motor hold relay 27 and at the same time apply the same $+V_1$ to the remaining stations through the line pair 12. As the commutator arm 18 starts to rotate into contact with segment 1, the $-V_1$ voltage impressed on that segment will be communicated to the other stations through line pair 12. In addition, $-V_1$ is coupled to the base of transistor 24 to temporarily deenergize the transistor to unclamp the gate input of the SCR allowing the SCR to be fired. FIG. 6 shows this $-V_1$ vacancy pulse occurring at the scanner position 1. Since this voltage at scanner position 1 is simultaneously present at all of the other stations, the light source 11 for section 1 of the visual display means will also be activated at all of the other stations.

Since motor hold relay 27 is temporarily actuated, switch 26 which normally supplies the SCRs anode voltage will open at the cycle start. The opening of the switch removes the anode voltage from all of the SCRs and serves to reset them to their stable condition of no conduction thus deenergizing all light sources 11. However, the motor relay 21 when energized closes its associated switch 42 which again connects a $+V_2$ voltage source to the anode of the SCRs to allow them to be triggered into an on condition as the commutator arm 18 sweeps onto the "1" segment and through the "30" segment to the standby position. Switch 26 closes when the capacitor 36 of the momentary close relay 31 is sufficiently discharged which is determined by the value of capacitor 36 and series connected resistors 37 and 38. A long enough time constant must be provided so that commutator arm 18 has time to sweep into contact with band 14 out of the blank space 17 to maintain energization of motor 43.

As further shown in FIG. 6 is stations 10, 11 and 27 also had their vacancy switch, S1, actuated, a $-V_1$ pulse would be transmitted to trigger the corresponding SCRs.

Thus, to summarize some of the features of the above invention, a cycle start pulse is produced either internally at a station or received on the interconnecting line pair to initiate the sequential sensing of all stations. At the start of scan cycle, the opening of switch 26 resets all of the SCRs to an off or first condition. The provision of capacitor 36 in conjunction with switch S1 provides for initiation of a scan cycle when the switch is moved from either of its positions. The normally saturated condition of transistors 24 provides noise immunity from spurious voltages received from the telephone line since a relatively large negative voltage $-V_1$ must be received to unclamp the trigger input of the SCRs. FIG. 5 is a more detailed schematic of FIG. 4 which has the added feature of a power failure relay 51 which couples input line 12 to rotary switch band 13 through a switch 52. Relay 51 is supplied a positive voltage $+V_2$ which may be, for example, 22 volts and the other side of the relay is grounded through a push button switch S3 which is bypassed by a capacitor C1. Thus relay 51 is normally energized maintaining the coupling between line pair 12 and commutator band 18. However, in the event of a power failure, the relay would be deactivated to disconnect the station from the line.

Relay 51 also includes a switch 53 which is in series with the cycle start line which couples the motor hold relay 27 to standby segment 23. Again this switch is normally closed, but when relay 51 is deenergized, it will open the cycle start circuit to segment 23 preventing the 130 volts from being applied from cycle start switch 32.

The rotary switch, itself, in addition to the segments 1 through 30 includes intermediate segments 54 which are coupled to ground through a current limiting resistor 55. These provide for a discharge or grounding of the input from line 12 to prevent the buildup of any unwanted charge.

Another added feature is the light, L, across motor 43 which indicates when the station is in the process of cycling. When this light is lit, the vacancy status switch, S1, should not be operated.

A testing procedure is provided by means of push button switch S3 which when operated deenergizes relay 51 in the same manner as if a power failure had occurred and couples a negative 130 voltage source through switch 52 to commutator band 13. This negative voltage is equivalent to $-V_1$ which referring to FIG. 6 is a vacancy indication. This negative vacancy indication is applied to all commutator segments 1 through 30 which, as discussed above, are coupled to the respective display sectors 1 through 30. The actual operating circuit of transistor 24 is illustrated with a +22 volt collector voltage ($+V_2$) and an appropriate 100 K. ohm biasing resistor for normally maintaining the transistor in a saturated condition clamping the trigger input of SCR-1 to ground.

Switch S1 is coupled to commutator segment 1 and functions in the same manner as discussed in the simplified schematic of FIG. 4. The momentary close relay 31 is coupled to a

+22 volt voltage source and is driven by a transistor Q1 which includes in its base circuit the resistors 37 and 38 which provide the proper time constant. The values of the resistors are indicated on the drawing along with that of the capacitor 36 which is part of the RC time delay circuit. The cycle start line is coupled through switch 53 from the standby segment 23 and through resistors R3 and R4 to transistor Q2 which drives the motor hold relay 27. A capacitor C3 is coupled across switch 28 of relay 27 to provide for transient currents. Similarly, the case of motor relay 21, switch 41 which energizes the motor 43 has a capacitor C4 across it to minimize arcing.

OPERATION

If it is desired to test whether all of the vacancy light sources 11 are operating the following test procedure is used in accordance with the present invention. Simultaneously, the test switch S3 is operated along with the cycle switch S2 which causes the scanning arm 18 to begin a scanning cycle. However, the operation of the test switch S3 has decoupled the station from the main line 12 and has coupled through switch 52 a 130 volt, $-V_1$, simulated vacancy indication. Thus, as scanning arm 18 sweeps across the commutator segments 1 through 30 all of the light sources 11 of display 10 are energized indicating a vacancy and indicating whether any light sources are inoperative. The scan cycle will automatically end when the discontinuity 17 in band 14 is reached. The station may be restored to normal operation by again pressing only cycle button, S2, with the test switch S3 in its normal position, at which time the anode voltage will be taken off the SCR's by switch 26 of relay 27 to reset them and any true vacancy indications present on the line will be sensed. Since the above testing procedure is used infrequently, switches S2 and S3 are normally located at the rear of the station.

FIG. 7 illustrates a station of a system where AC signals of two different frequencies may be used to communicate between stations. Thus, in the case where ordinary telephone lines are used to interconnect the multiple stations, cross country lines may be utilized where transmission is by carrier or where there may be microwave links in the telephone line. FIG. 7 is actually a modification of FIG. 4 with similar elements receiving like numbered numerals. The major modification is the replacement in switch S1 of the negative voltage source with two frequency generators; namely, a generator labeled v_1 which may, for example, generate a frequency of 350 Hz. and a second generator, v_2 , which may, for example, generate a frequency of 1,850 Hz. These are selectively coupled to commutator segment 1 by a switching arm 32'. As indicated, the switching arm is now in a vacancy condition coupling frequency v_2 to commutator segment 1. In its other position this is a no vacancy indication.

When switch S1 is switched from one condition to the other, momentary close relay 31 is activated in the same manner as above closing switch 29 to couple AC voltage v_1 to the telephone line through commutator ring 13. This cycle start voltage is then detected by a v_1 detector 101 which couples its DC output to motor hold relay 27. The cycle start signal may be either the v_1 voltage as shown or the v_2 frequency voltage since upon the initiation of the scan cycle of motor 18 this voltage is disconnected from the circuit. Motor 43 is activated by motor hold relay as discussed above. When brush 22 passes over commutator segment 1 the v_2 voltage, or whatever may be the case, is coupled through to a bistable flip-flop circuit 102 through a v_2 detector 103. Light 11 is then activated if not already on. If a v_1 type signal was present then the v_1 detector 104 would cause flip-flop 102 to switch to a condition to inactivate light 11.

The remaining commutator segments 2 through 30 are coupled to similar light units which would include two detectors and a flip-flop device.

The above system of FIG. 7 can also be modified so that the v_1 , v_2 signals are pulse code modulated or frequency modulated. This would entail merely modification of the v_1 , v_2 detectors.

Where it is desired to utilize a station as only a sender unit to, for example, communicate its condition to the remaining stations of the systems but where it is not necessary to display the conditions of the other stations, the light units may be eliminated leaving only a commutator segment connected for the station which the sender represents.

Thus, in summary the present invention provides an improved multiple station intercommunications system which simultaneously displays any vacancy indications for all stations and in which the effects of noise on the interconnecting circuitry between the stations is minimized by the technique of utilizing a saturated transistor in combination with a silicon controlled rectifier. Communication between stations is accomplished by either a change in DC level or through signals of two different frequencies.

I claim:

1. A multiple station intercommunications system where each station may be placed either in a first or second condition, each station including visual display means which indicate the conditions of all stations, the improvement comprising: a plurality of visual display means at each of said stations having first and second conditions, each of said display means corresponding to each of said stations, a plurality of bistable means at each of said stations, one corresponding to each of said stations and coupled to a corresponding visual display means, each of said bistable means at each of said stations being responsive to the first and second conditions of the corresponding station to permanently place said display means in said first condition if said corresponding station is in said first condition and permanently in said second condition if said corresponding station is in said second condition, each of said stations also including means for sequentially sensing the condition of each of said stations, means for producing a cycle start pulse to initiate said sequential sensing, and means responsive to said cycle start pulse for resetting said plurality of bistable means to a state corresponding to said first condition wherein each station provides a simultaneous display of the condition of all stations.

2. A system as in claim 1 where each station includes means for producing said cycle start pulse in response to such station changing from either of said conditions to the other.

3. A system as in claim 2 where said start cycle producing means include a capacitor.

4. A system as in claim 1 where each station is located at a hotel and where said first condition is one of no vacancy and said second condition indicates a vacancy.

5. A system as in claim 1 where said bistable means are silicon controlled rectifiers having anode, cathode and gate terminals.

6. A system as in claim 5 where a transistor is coupled to said gate terminal of each rectifier, said transistor normally clamping said gate to ground said transistor being responsive to said second condition of said stations for unclamping said gate.

7. A system as in claim 1 including internal test means for each station for testing said visual display means, said test means comprising switching means for disconnecting the station under test from all other stations and for concurrently simulating a second condition for all stations.

8. A system as in claim 1 in which said bistable means are flip flop devices.

9. A system as in claim 1 where in said first condition a station produces a first signal of a first type and in said second condition produces a second signal of a second type.

10. A system as in claim 9 in which said first signal is of one frequency and said second signal is of a different frequency.

11. A system as in claim 9 in which said bistable means are responsive to said first and second signals to switch from one state to the other of said bistable means.

12. A system as in claim 1 where each station includes means for sequentially sensing the condition of each of said stations.

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