This invention relates generally to an intercommunication system, and particularly to a system which is intended to be used in a hospital between the nurses' station and the rooms of the patients served by the nurses at that station.

Hospital intercommunication systems which have provision for both visual and audible communication are generally characterized by complexity and expense of installation, particularly in regard to the wiring of such systems. Many older hospitals have intercommunication systems which provide only visual communication between the patients' rooms and the nurses' station. Such systems are generally of the three-wire type, in which two wires are common to all of the patients' rooms and there is additionally an individual third wire for each room, all connected to the nurses' station. When such hospitals desire to change over from the visual system to an audible-visual system, the existing wiring cannot be used for the new intercommunication equipment and it is necessary to install a whole new wiring system. Obviously, this is quite costly and sometimes interferes with the normal routine of the hospital floor where such replacement is taking place.

The present invention is directed to a novel audible-visual intercommunication system which is especially adapted for use in hospitals.

Other and further objects and advantages of the present invention will be apparent from the following detailed description of a preferred embodiment thereof, which is schematically illustrated in the single figure of the accompanying drawing.

In the drawing, the block labeled "remote station #1" represents the equipment associated with one patient's room. It comprises a relay K having movable contacts 10, 11 and 12. Contact 10 is connected through a normally-closed switch 13 to a line 14 which leads to one side of the coil of relay K. Switch 13 is intended to be operated by a nurse answering the patient's call. A normally-open switch 15 is connected between line 14 and line B, which is one of the two wires common to all of the patients' rooms. A suitable power source, such as battery 16, is connected across line B and a second line W which is common to all of the rooms. Switch 15 is intended to be operated by the patient. Both switches 13 and 15 may be of the push-button, self-return type so that after being actuated momentarily they resume their normal positions. Both of these switches are located at the patient's room.

Stationary relay contact 17, which is associated with mobile contact 16, is connected through line 18 to switch 15. Line 18 and relay contacts 17 and 10 provide a holding circuit for relay K which maintains the coil of this relay energized after it has been energized initially by the momentary closing of switch 15 by the patient.

The mobile relay contact 11 is also connected directly to line 18. Fixed relay contact 19, which is associated with mobile contact 11, is connected through a pair of parallel-connected lamps 20 and 21 to the common line W. Desirably, one of these lamps is adjacent the patient's bed and the other is just outside his room so as to be visible in the corridor.

Fixed relay contact 22, which is associated with mobile contact 12, is connected directly to line W. Mobile contact 12 is connected through a condenser 23 to loudspeaker microphone 24. The opposite side of speaker microphone 24 is connected through line 25 to the opposite side of the coil of relay K. Line 25 also is connected to line R1, which is the individual third wire which completes the three-wire system at "remote station #1." In the normal condition of relay K, that is, with the relay coil de-energized, contacts 10 and 17 are open, contacts 11 and 19 are open, and contacts 12 and 22 are closed. Thus, normally the lamps 20 and 21 are unlighted and speaker 24 is in condition to be energized.

At "remote station #2" which is the next patient's room along the corridor, there is provided an essentially identical arrangement to that just described. The corresponding elements at "remote station #2" are designated by the same numerals, with the suffix "2" added. The lamps 20u and 21u are connected to the common wire W, as is the fixed relay contact 22u. The normally open switch 15u is connected directly to the other common wire B. Speaker 24u and line 25u are connected to another third wire R2 which is individual to that particular room and completes the three-wire system for that room.

Obviously, in the visual case there will be many more than two remote stations associated with a single central station for the nurses. However, in order to simplify the present description only two such remote stations are shown. The connections for the additional remote stations would be the same as those just described, each having connections to all of the rooms. Lamp 1u is connected between fixed contact 41 and the common wire W.

At the "central station" there are provided a lamp and a switch for each remote station. The switch S1 for communication with "remote station #1" has its movable contact 40 normally closed against a fixed contact 41. Mobile contact 40 is connected to the third wire R1 coming from "remote station #1." Lamp 1u is connected between fixed contact 41 and the common wire W.

Similarly, switch S2 (for "remote station #2") has its mobile contact 50 normally closed against fixed contact 51. Mobile contact 50 is connected to the third wire R2 coming from "remote station #2." Lamp 1u is connected between fixed switch contact 51 and the common wire W.

A phone 69 at the nurses' desk is connected to a conventional voice-operated amplifier 61. Another terminal of this amplifier is connected to the normally-open, fixed switch contacts 42 and 52. The negative terminal of 63 of the amplifier is connected directly to the common line line W. Alternatively, a conventional "talk-listen" switch might be used in place of the voice-operated amplifier 61.

In operation, in the normal, unoperated condition of the system the various switches and relay contacts are as shown in the drawing, all of the relays being de-energized at this time.
If a patient at "remote station #1" desires to call the nurse, he closes switch 15 momentarily. This completes the closed circuit for the coil of relay K as follows: From positive line B, through the now-closed switch 15 and line 14 to one side of the relay coil, and from the opposite side of the relay coil through line 25, third-wire line R1, the normally closed contacts 40 and 41 of switch S1 at the central station, and lamp L4 to the negative line W. Therefore, such initial energization of relay K causes lamp L1 to be lighted, thereby signaling the nurse at the central station.

Such initial energization of relay K also causes its mobile contact 10 to close on fixed contact 17, its mobile contact 11 to close on fixed contact 19, and its mobile contact 12 to separate from fixed contact 22.

The closing of relay contacts 10 and 17 completes a holding circuit for the relay as follows: From positive line B through line 18, relay contacts 17 and 10, normally closed switch 13 and line 14 to one side of the relay coil, and from the opposite side of the relay coil through lines 25 and R1, the S1 switch contacts 40 and 41, and lamp L1 to the negative line W. Due to this holding circuit, the coil of relay K remains energized after the patient has released switch 15 and the switch has returned automatically to its normally-open condition.

With the K relay contacts 11 and 19 closed, the lamps 20 and 21 are energized as follows: From positive line B through line 18, relay contacts 11 and 19, through the parallel-connected lamps 20 and 21 to the negative line W. Thus, the initial closing of switch 15 by the patient causes the lamp 28 outside his room to be lighted and also the lamp 21 at his bed. The lamp 20 is for the purpose of attracting the attention of a nurse who might be nearby in the corridor. Lamp 21 is provided to indicate to the patient that he has signaled for a nurse.

The opening of relay contacts 12 and 22 by the energization of the K relay coil disconnects the energization circuit for the speaker 24 at this time.

With lamp L1 lighted at the central station, the nurse on duty there will be notified of the patient's call. When this nurse operates the corresponding switch S1, the energization circuit for relay K and for lamp L1 is broken. As a consequence of the de-energization of relay K, its holding contacts 10 and 17 open, its contacts 11 and 19 open and thereby break the energization circuit for lamps 20 and 21, and its contacts 12 and 22 re-close.

When the nurse speaks into phone 60, her voice is transmitted through the voice-output transformer 61, the telephone circuit, the closed parallel means 42 and 48 of switch S1, and line R1 to the speaker-microphone in the room of the patient who has signaled. When the nurse stops talking, the calling patient can talk to her through the speaker-microphone 24 and the circuitry just described. The amplifier 61 has a conventional arrangement which permits conversation only one way at a time.

The same result could be accomplished by providing a "talk-listen" switch at the central station under the nurse's control.

In addition to being resettable at the central station, the system may also be reset at the remote station which put in the call. Thus, if a nurse happens to be in the corridor near the calling patient's room she can open the normally-closed switch 13 at that room. This de-energizes the relay K by breaking its holding circuit. Consequently, lamps 20 and 21 become de-energized and the corresponding lamp L1 at the central station also goes out, indicating to the nurse there that the call has been answered.

The arrangement and operation of the system at each of the other remote stations is identical to that just described and need not be repeated in detail.
extending from the respective remote station to the central station, switch means at the central station connected to the respective third wires to control the energization of the respective relays from said power supply means to thereby control the operation of the respective visual signaling means and audible communication means at the respective remote stations, visual signaling means and audible communication means at the central station, connections from said last-mentioned switch means to the visual signaling means and the audible communication means at the central station, and additional means connecting the visual signaling means and the audible communication means at the central station to one side of said power supply means.

5. The system of claim 5, wherein said switch at each remote station is normally open to maintain the corresponding relay normally de-energized, each relay has an additional set of normally open contacts which close in response to the initial energization of the relay by the closing of said switch, and wherein there are provided connections from said additional set of contacts to one of said pair of wires and to the third wire for that remote station which provide a holding circuit for maintaining the corresponding relay energized following its initial energization by the closing of said switch.

6. The system of claim 5, wherein there is provided a normally-closed second switch located at each remote station and connected in the holding circuit for the corresponding relay.

7. The system of claim 4, wherein the first set of contacts at each relay are normally open, said first set of contacts closing in response to energization of the relay and connecting the corresponding visual signaling means across said pair of wires.

8. The system of claim 4, wherein the second set of contacts at each relay are normally closed and connect the corresponding audible communication means across one of said pair of wires and the third wire individual to that remote station, said second set of contacts opening in response to the energization of the relay.

9. The system of claim 4, wherein said switch at each remote station is normally open to maintain the corresponding relay normally de-energized, each relay has an additional set of normally open contacts which close in response to the initial energization of the relay by the closing of said switch, and wherein there are provided connections from said additional set of contacts to one of said pair of wires and to the third wire for that remote station which provide a holding circuit for maintaining the relay energized following its initial energization by the closing of said switch, and the first set of contacts at each relay are normally open, said first set of contacts closing in response to energization of the relay and connecting the corresponding visual signaling means at that remote station across said pair of wires, and the second set of contacts at each relay are normally closed and connect the corresponding audible communication means across one of said pair of wires and the third wire for that remote station, said second set of contacts opening in response to energization of the respective relay.

10. The system of claim 9, wherein there is provided a normally-closed switch located at each remote station and connected in the holding circuit for the corresponding relay.

11. An audible-visual intercommunication system for communication between a central station and each of a plurality of remote stations comprising visual and audible communication means at the central station, visual and audible communication means at each of the remote stations, power supply means, means connecting said visual and audible communication means at the central station to said power supply means, a pair of wires connected across said power supply means and extending to each of the remote stations, a third wire individual to each remote station and extending therefrom to the central station, control circuits at the respective remote stations connecting said pair of wires to the visual and audible communication means at the remote stations, said control circuits including electrically energizable control means at each remote station connected between one of said pair of wires and the third wire for that remote station, switch means at each remote station connected in the control circuit thereat to control the energization of said electrically energizable control means thereat, switch means at the central station connected to the third wire for each remote station to control the energization of the electrically energizable control means at that remote station, and connections from said last-mentioned switch means to the visual and audible communication means at the central station.

12. An audible-visual intercommunication system for communication between a central station and each of a plurality of remote stations comprising visual and audible communication means at the central station and at each of the control stations, power supply means, means connecting said visual and audible communication means at the central station to said power supply means, a pair of wires connected across said power supply means and extending to each of the remote stations and having connections to the visual and audible communication means thereat, a third wire individual to each remote station and extending therefrom to the central station, control means at each remote station connected to control the operation of the visual and audible communication means thereat, and control means at the central station connected to the third wires to control the operation of the visual and audible communication means at each of the remote stations.

13. The system of claim 12, wherein the control means at the central station is connected to control the operation of the visual and audible communication means thereat.

14. An audible-visual intercommunication system for communication between a central station and each of a plurality of remote stations comprising visual and audible communication means at the central station and at each of the remote stations, a pair of wires extending to all of the remote stations, a third wire individual to each remote station and extending therefrom to the central station, power supply means having connections to the several wires, means connecting said visual and audible communication means at the central station to said power supply means, control means at each remote station having connections to the wires thereat and to the visual and audible communication means thereat to control the operation of said visual and audible communication means at the remote station, and control means at the central station having connections to the third wires and to the visual and audible communication means at the central station to control the operation of the visual and audible communication means at each of the remote stations and at the central station.

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