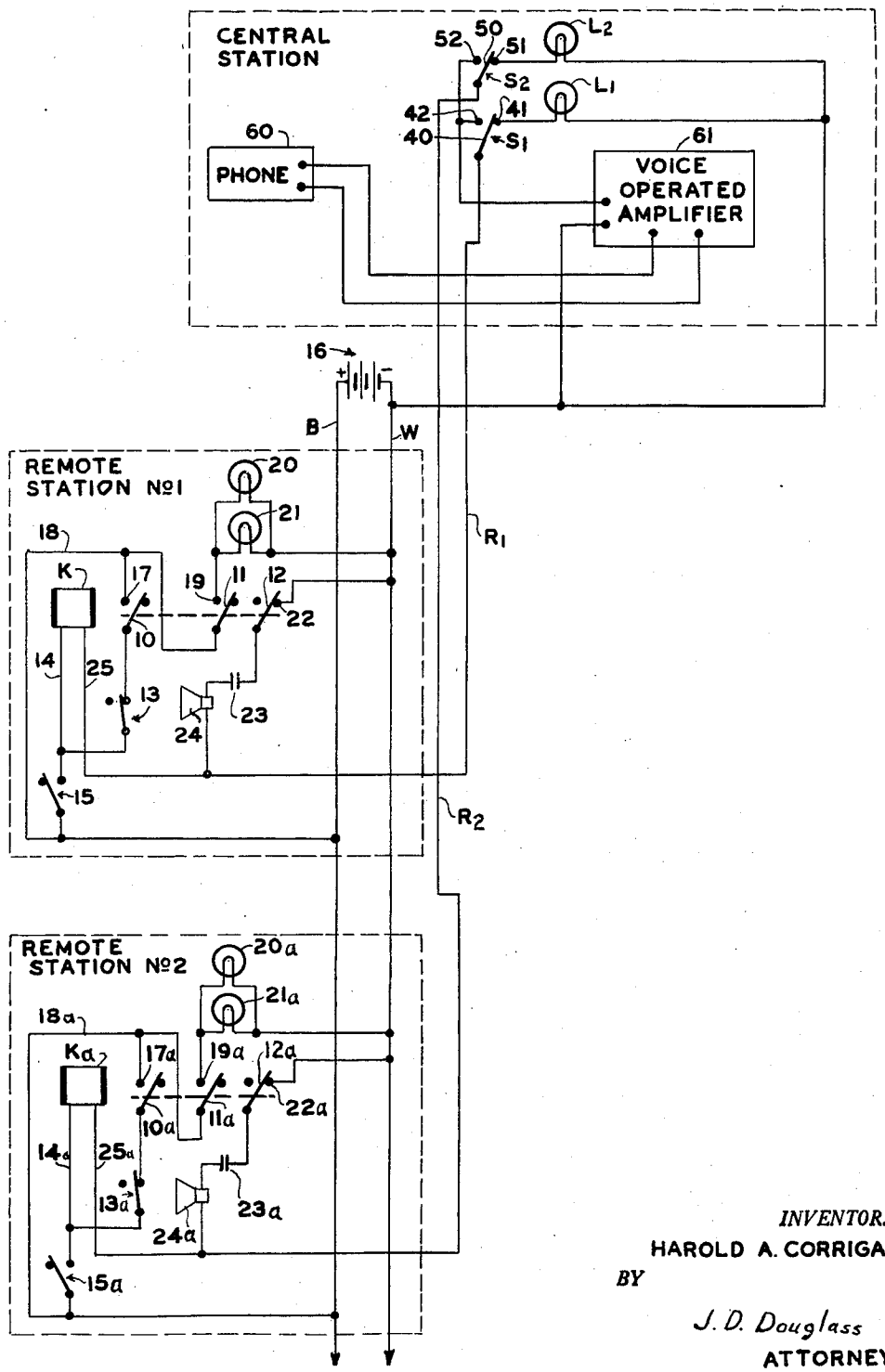
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AUDIBLE-VISUAL INTERCOMMUNICATION SYSTEM

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AUDIBLE-VISUAL INTERCOMMUNICATION SYSTEM

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This invention relates generally to an intercommunication system, and particularly to such a system which is intended for use 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 with an already existing three-wire wiring system already in use with a visual intercommunication system. While the present system is particularly advantageous from this viewpoint, it is also advantageous for initial installation as an intercommunication system in new hospitals because of the simplicity of its wiring and the reliability and simplicity of its various components.

Accordingly, it is an object of the present invention to provide a novel and improved audible-visual intercommunication system.

It is also an object of this invention to provide such an 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 prefered 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 **10**, 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 the relay K. Line **25** also is connected to line R_1, 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 "*a*" added. The lamps **20***a* and **21***a* are connected to the common line W, as is the fixed relay contact **22***a*. The normally open switch **15***a* is connected directly to the other common wire B. Speaker **24***a* and line **25***a* are connected to another third wire R_2 which is individual to that particular room and completes the three-wire system for that room.

Obviously, in the usual 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 the common wires B and W and an individual third wire for each remote station.

At the "central station" there are provided a lamp and a switch for each remote station. The switch S_1 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 R_1 coming from "remote station #1." Lamp L_1 is connected between fixed contact **41** and the common wire W.

Similarly, switch S_2 (for "remote station #2") has its mobile contact **50** normally closed against fixed contact **51**. Mobile contact **50** is connected to the third wire R_2 coming from "remote station #2." Lamp L_2 is connected between fixed switch contact **51** and the common wire W.

A phone **60** 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 **63** of the amplifier is connected directly to the negative common 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 an energization 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 R_1, the normally closed contacts 40 and 41 of switch S_1 at the central station, and lamp L_1 to the negative line W. Therefore, such initial energization of relay K causes lamp L_1 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 R_1, the S_1 switch contacts 40 and 41, and lamp L_1 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 20 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 signalled 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 L_1 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 S_1, the energization circuit for relay K and for lamp L_1 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-operated amplifier 61, the now-closed contacts 42 and 40 of switch S_1 and line R_1 to the speaker-microphone in the room of the patient who has signalled. 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 L_1 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.

From the foregoing, it will be apparent that the present audible-visual intercommunication system requires only the three-wire circuitry already in use for conventional visual only intercommunication systems. Moreover, it has the advantage of being resettable at either end, that is, at the calling station or at the central station, so that it provides the optimum of convenience and practical utility.

While there has been described in detail herein and illustrated in the accompanying drawing a specific presently preferred embodiment of this invention, it is to be understood that various modifications, omissions and refinements which depart from the disclosed embodiment may be adopted without departing from the spirit and scope of the present invention.

I claim:

1. An audible-visual intercommunication system for communication between a central station and each of a plurality of remote stations comprising audible and visual communication means at the central station and at each of the remote stations, power supply means for said audible and visual communication means, and wiring interconnecting the remote stations, the central station and said power supply means, said wiring consisting of a pair of wires connected to said power supply means and to all of said remote stations, a third wire individual to each remote station and connected therefrom to the central station, and additional means connecting said audible and visual communication means at the central station to one side of said power supply means.

2. An audible-visual intercommunication system for communication between a central station and each of a plurality of remote stations comprising audible and visual communication means at the central station and at each remote station, control means at each remote station connected to the audible and visual communication means thereat to control the latter's operation, power supply means, a pair of wires connected across said power supply means and having connections to the control means and to the audible and visual communication means at all of the remote stations, a third wire individual to each remote station and connected therefrom to the central station, each said third wire being connected between said power supply means and the respective control means at the corresponding remote station, switch means at the central station connected to the respective third wires to control the energization of said control means for the individual remote stations to thereby control the operation of the audible and visual communication means at the respective remote stations, connections from said switch means to the audible and visual communication means at the central station, and additional means connecting said audible and visual communication means at the central station to one side of said power supply means.

3. The system of claim 2, wherein there is provided an additional switch means at each remote station connected to said control means thereat to control the latter's operation.

4. An audible-visual intercommunication system for communication between a central station and each of a plurality of remote stations, said system comprising a relay at each remote station, visual signalling means at each remote station, each relay having a first set of contacts connected to said visual signalling means at that remote station to control the latter's operation, audible communication means at each remote station, each relay having a second set of contacts connected to the audible communication means at that remote station to control the latter's operation, power supply means, a pair of wires connected across said power supply means and having connections to the relay and to the visual signalling means and the audible communication means at all of the remote stations, a switch at each remote station connected between said power supply means and the relay at said remote station to control the initial operation of said relay, a third wire individual to each remote station and connected between said power supply means and the relay at that remote station, each third wire

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 signalling means and audible communication means at the respective remote stations, visual signalling means and audible communication means at the central station, connections from said last-mentioned switch means to the visual signalling means and the audible communication means at the central station, and additional means connecting the visual signalling means and the audible communication means at the central station to one side of said power supply means.

5. 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 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 signalling 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 signalling means at that remote station across said pair of wires, and the second set of contracts 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 comunication 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 comunication 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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