United States Patent

Holstrom

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[54] APARTMENT HOUSE INTERCOM SYSTEM

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[52] **U.S. Cl.** ..... **179/37**, 179/1 H

[51] **Int. Cl.** **H04m 7/10**

[58] **Field of Search** ..... 179/1 H, 37, 2 A

[56] **References Cited**

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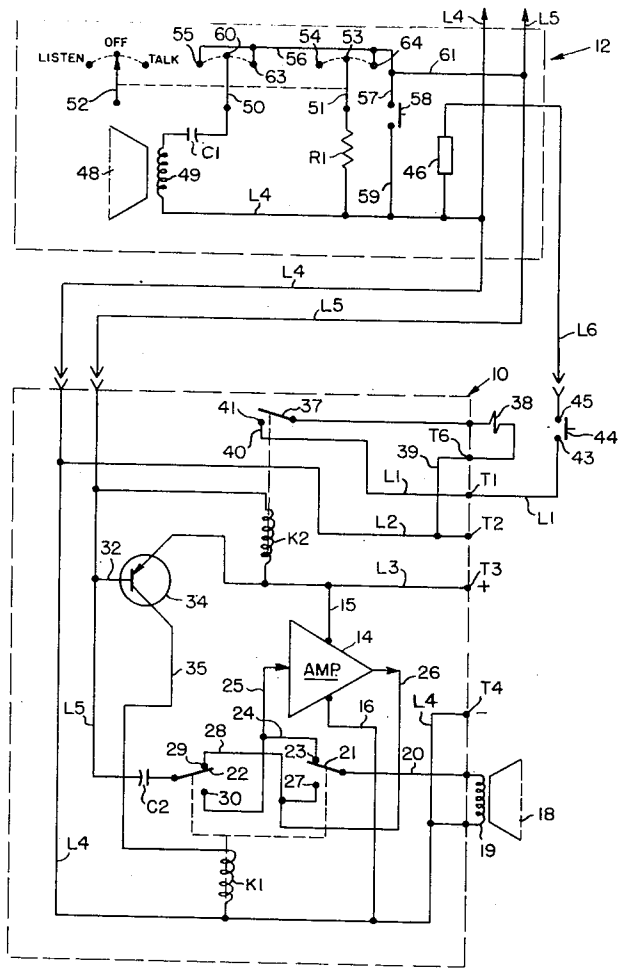
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[57] **ABSTRACT**

With this system only two wires are needed to transmit audio signals between a speaker-microphone unit located at a central or foyer station, and any one of a plurality of such units located at apartments remote from the foyer station. A transistorized relay at the central station normally connects the foyer unit for transmission to the remote units, but is responsive to a manually operable switch at each remote station to connect a selected remote unit for transmission to the foyer speaker. The same two wires are used to transmit a door unlatching signal from any remote unit to a release mechanism at the foyer station. Also, a buzzer energizing signal may be transmitted from the foyer station over a single line selectively to one of two of the remote apartment stations.

2 Claims, 2 Drawing Figures



2 Sheets-Sheet 1

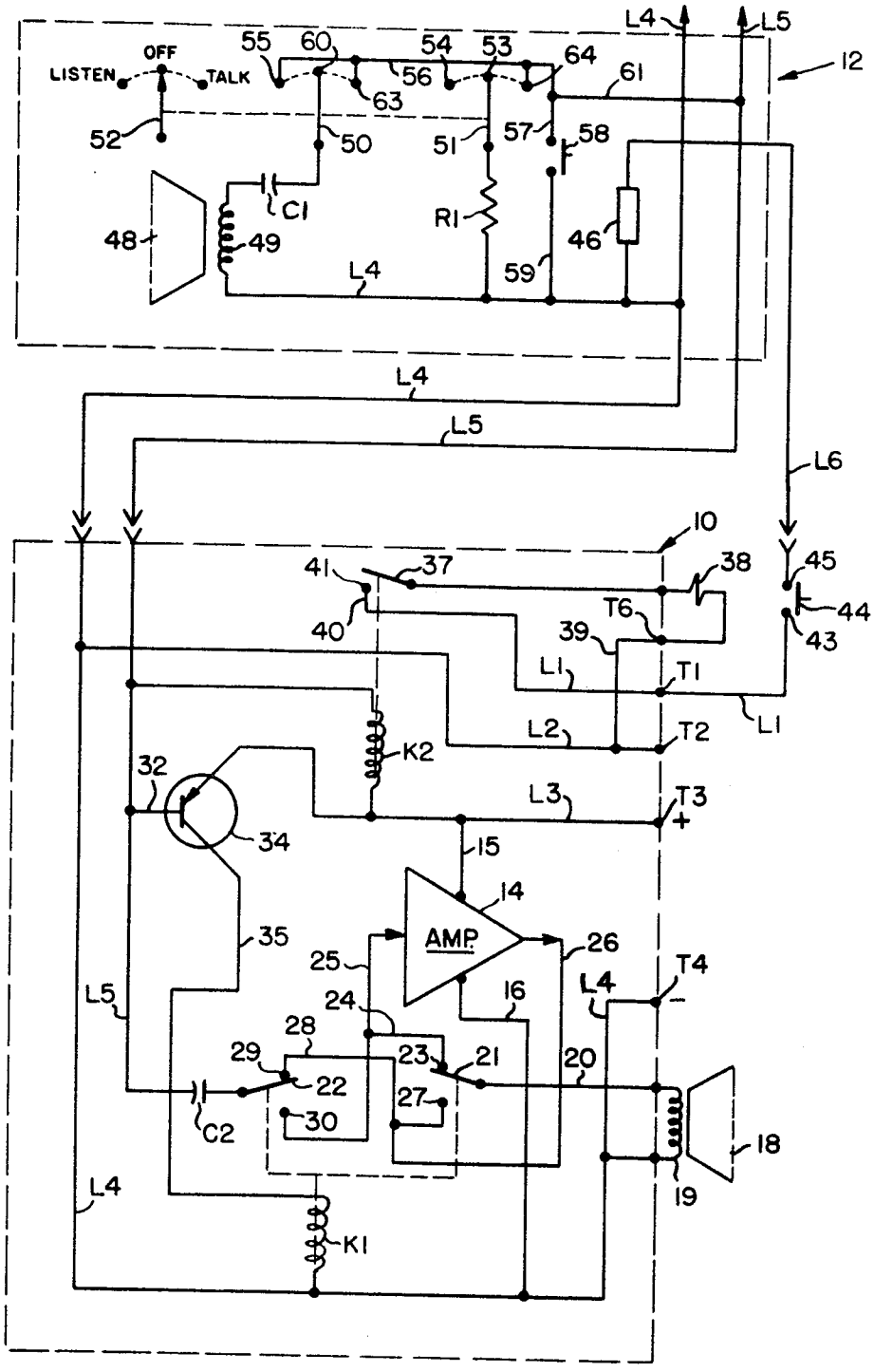


FIG 1

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ATTORNEYS

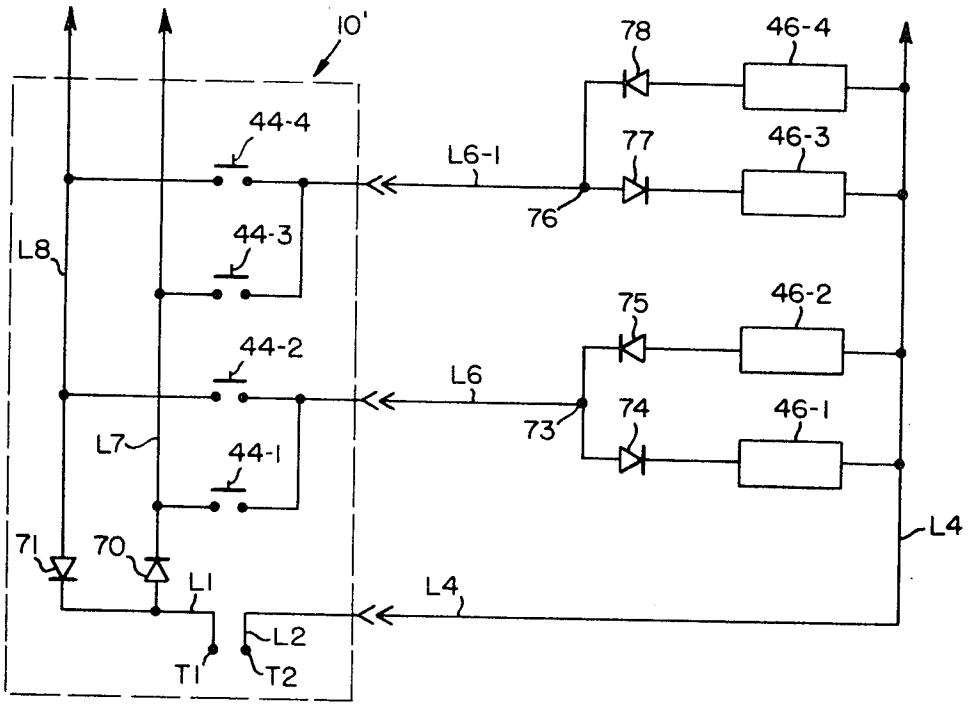


FIG. 2

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APARTMENT HOUSE INTERCOM SYSTEM

This invention relates to communication systems, and more particularly to an apartment house loud speaking intercom system which permits audio communication from any of the several apartment suites to the main entrance or foyer of the apartment house with a minimum number of low voltage and low current interconnecting wires.

Most apartment house intercom and/or door answering systems comprise a buzzer operable by a switch located in the entrance foyer to signal the presence of a caller, a combination speaker-microphone unit in each apartment, a control switch with OFF, LISTEN, and TALK positions, and a push-button to release the lock on the door at the entrance from the foyer to permit a caller to enter the apartment house. This equipment is connected by a plurality of conductor wires or lines to a power supply, a central amplifier, and to a loud speaker unit installed in the main entrance foyer.

Such intercom installations traditionally have required between each apartment, and the central or foyer amplifier usually, two lines for producing an audio signal, two wires for controlling a talk/listen relay located at the central amplifier, two wires for completing the door release circuit, and two wires for connecting the buzzer in each apartment station to the foyer pushbutton panel and power supply.

The obvious way of reducing the number of wires in such an intercom system is to have one wire common for each of the four circuits, thereby making a total of five wires including one for the signalling buzzer, instead of the eight wires.

It is an object of this invention to reduce the amount of wiring needed for an apartment house intercom system even beyond this obvious reduction.

A further object of this invention is to provide an improved apartment house intercom system, which is substantially more compact, inexpensive, and is easier to install than prior systems.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims, particularly when read in conjunction with the accompanying drawings.

In the drawings:

FIG. 1 is a wiring diagram illustrating schematically an apartment house intercom system wired in accordance with one embodiment of this invention; and

FIG. 2 is a wiring diagram illustrating a modification of part of this system.

Referring now to the drawings by numerals of reference, and first to FIG. 1, 10 represents generally a central amplifier station located, for example, in the vestibule or central entrance foyer of an apartment house; and 12 represents a typical station installed in each apartment for operation in conjunction with the central amplifier station 10.

Station 10 comprises a pair of alternating current (AC) input terminals T1 and T2, which are connected to an AC power supply (not illustrated), and two further terminals T3 and T4, which are connected to a direct current (DC) power supply (not illustrated).

The DC power supply is used to energize a conventional audio amplifier 14 and for this purpose the positive terminal T3 is connected by a line L3, and a line 15 to one side of the amplifier, and the negative terminal T4 is connected through a ground line L4 and a line 16 to the opposite side of the amplifier. Line L4 also extends to apartment stations 12 in the associated apartment building in a manner which will be described in more detail below.

Station 10 further includes a combination speaker-microphone unit 18, the operating coil 19 of which is connected at one end to the line L4, and at its opposite end by a line 20 to a movable relay contact or switch arm 21, which is one of two movable switch contacts or arms 21 and 22 that are controlled by a relay coil K1. Arm 21 is engageable with spaced stationary contacts 23 and 27; and arm 22 is engageable with spaced stationary contacts 29 and 30. Contact 23 is connected by lines 24 and 25 to the input of amplifier 14; and the output of the amplifier is connected by a line 26 to contact 27, and line 28 to contact 29. Contact 30 is also connected to the input of the amplifier through line 25.

Normally, that is when the relay coil K1 is deenergized, the switch arm 21 is engaged with a stationary contact 23, and switch arm 22 is engaged with the stationary contact 29, thus connecting the output of the amplifier 14 through a capacitor C2 to a communication line L5, which extends from the amplifier station 10 to each of the apartment stations 12. At the amplifier station 10, the line L5 is also connected by a line 32 to the base of a transistor 34, the collector of which is connected through a line 35 and the relay coil K1 to the ground line L4. The emitter of the transistor 34 is connected to the positive terminal T3 of the DC power supply by the line L3.

Also connected at one end to the line L3 and at its opposite end to the line L5 is a further relay coil K2, which controls a normally open switch arm 37. Switch arm 37 is adapted to control a conventional door-release mechanism, which, by way of example, is illustrated in the drawing as being a solenoid 38. Solenoid 38 is connected at one end through a further terminal T6 and lines 39 and L2 to the AC input terminal T2. The other AC terminal T1 is connected by lines L1 and 40 to a stationary relay terminal 41, that is engageable by the switch 37, when the latter is closed, thereby to energize the solenoid 38. The solenoid 38, when energized, operates to release a conventional door latching mechanism such as employed in the entrances of apartment houses.

The terminal T1 is also connected by the line L1 to one contact 43 of a normally open pushbutton type switch, which is operable in the foyer by a visitor to signal his or her presence to the resident of an apartment in the apartment house. The other terminal 45 of this switch is connected by a line L6 to a conventional buzzer 46, which is mounted in an apartment station 12. The opposite side of the buzzer 46 is connected to the line L4.

At the typical apartment station 12 a combination speaker-microphone unit 48 has its operating coil 49 connected at one end to the ground line L4, and at its opposite end through a capacitor C1 to a movable, three-position switch arm 50. Also connected at one end to the line L4 at the apartment station 12, and at its opposite end to a further pivotal or movable switch arm 51, is a resistance R1. Switches 50 and 51 form part of a conventional, manually operable, three-position control switch 52, which is mounted at the apartment station 12 for movement selectively between three different positions identified as LISTEN, OFF and TALK, respectively. The switch 52 is spring-loaded so that it normally is disposed in its OFF position.

When this switch 52 is in its OFF position, the movable switch contacts 50 and 51 register with dead-ended contacts 60 and 53, respectively, and coil 49 and resistor R1 are deenergized. When the switch 52 is moved to its LISTEN position, contact 51 is swung into engagement with a further dead-ended contact 54; and switch arm 50 is swung into engagement with a contact 55, which is connected by lines 56 and 61 to the line L5, and by lines 56 and 57 to one side of a normally open, manually operable pushbutton switch 58, the opposite side of which is connected by a line 59 to line L4.

In use, a visitor signals the resident of the apartment by pushing the button 44, which is located in the foyer. This completes a circuit from the AC terminal T1 through line L1, switch 44, line L6, buzzer 46 in the apartment, and line L4 back to station 10 where line L4 is connected to terminal T2 by line L2. The buzzer 46 is thus energized across the AC power supply, when the switch 44 is closed.

When the resident of the apartment hears the buzzer 46, he or she moves switch 52 to its LISTEN position, thus completing the circuit from negative terminal T4 of the DC power supply through line L4, foyer speaker coil 19, line 20, switch 21, contact 23, and lines 24 and 25 to the input of amplifier 14. At this time the output of the amplifier is connected through lines 26 and 28, contact 29, switch arm 22, capacitor C2, lines L5, 61, 56, contact 55, switch arm 50, capacitor C1 and the apartment speaker coil 49 to ground line L4. The

foyer speaker thus functions at this time as a microphone, its input being applied to the amplifier **14**; and the apartment speaker **48** functions as a speaker, its input being received from the output of the amplifier **14**. The capacitors C1 and C2 operate to isolate the relay coil K2 from any direct current flow, so that the coil K2 remains deenergized at this time. Also, the base and the emitter of the transistor **34** are at the same potential, so that the transistor is in its normal blocking or essentially non-conductive state, so that the relay coil K1 is also deenergized at this time.

After the visitor has been identified, the resident of the apartment may shift switch **52** to TALK position, thereby connecting the movable switch arms **50** and **51** with contacts **63** and **64**, both of which are connected to the line **56**. This operates to connect the resistance R1 in parallel with the speaker coil **49** and the capacitor C1, and also completes the circuit from the positive DC input terminal T3 to line L3, relay coil K2, lines L5, **61** and **56**, switch arm **51** and resistance R1 to ground line L4. The resistance R1, however, has an ohmic resistance at least 10 times that of the coil K2, so that only a very slight amount of current is allowed to flow through the coil K2 and resistance R1. Although this quantity of current is not sufficient to energize the coil K2 to close the switch **37**, it does create a potential difference between the collector and base of transistor **34**, whereby the latter is switched to its conducting state, thereby energizing relay coil K1 from T3, through line L3, the collector circuit of transistor **34**, line **35**, and coil K1 to ground line L4 and terminal T4. Coil K1 then operates to swing switch contacts **21** and **22** into engagement with stationary contacts **27** and **30**, respectively, thereby connecting the apartment speaker **48** to the input of amplifier **14**, and connecting the output of the amplifier to foyer speaker **18**. Signals developed in the coil **49** are thus connected through capacitor C1, switch **50**, lines **56**, **61** and L5, capacitor C2, switch **22**, contact **30** and line **25** with the input of the amplifier **14**. The amplifier output is connected at this time through line **26**, contact **27**, switch **21** and line **20** with the coil **19** in foyer speaker **18**. The apartment speaker **48** now operates as a microphone to permit the resident of the apartment to speak to the visitor through foyer speaker **18**.

If the resident of the apartment, after identifying the visitor, wishes to admit the visitor to the apartment house, the resident pushes pushbutton **58** at station **12**, thereby completing the circuit from the positive DC terminal T3 through line L3, relay coil K2, lines L5, **61** and **57**, switch **58**, and line **59** to ground line L4. This circuit connects coil K2 directly across the DC power supply, so that the coil is fully energized, thereby closing switch **37**, and energizing solenoid **38**. As noted above, this releases the latching mechanism on the door at the main foyer entrance.

From the foregoing it will be apparent that only two wires L4 and L5 are required for connecting the amplifier station **10** to the typical apartment station **12** in order to enable the transmission of audio signals back and forth between the main station and any one of the remote apartment stations, and also to permit operation of the door unlatching mechanism from any of the apartment stations. Furthermore, by adding a third wire L6, applicant's novel system is capable of performing all of the numerous functions required of an apartment house intercom and signalling system of the type described. In addition, the same two lines L4 and L5 can be used for a plurality of apartment stations **12**, thereby considerably reducing the amount of wiring, as compared to prior systems.

While in the embodiment of FIG. **1** there must be at least one different line L6 for each apartment station **12**, FIG. **2** illustrates a novel system in which a single such line L6 can be employed for selectively operating the buzzers or signalling devices of at least two separate apartments or stations **12**. In this embodiment, wherein like numerals are employed to denote elements similar to those employed in the embodiment of FIG. **1**, the buzzers or signalling devices **46–1**, **46–2**, **46–3** and **46–4** denote the buzzers of four different apartments or stations similar to the station **12** of FIG. **1**. Also, **10'** denotes a central or foyer amplifier station similar to station **10** of FIG. **1**, but including four, manually operable pushbuttons **44–1**, **44–2**, **44–3**, and **44–4** for activating the buzzers **46–1**, **46–2**, **46–3** and **46–4**, respectively.

As in the preceding embodiment, the input terminal T2 of the AC power supply is connected through line L2, and the line L4 to one side of each of the four different apartment buzzers **46–1**, **46–2**, **46–3** and **46–4**. The other AC input terminal T1 is connected by the line L1 and a diode **70** to a first trunk line L7 at the foyer station, and through a second diode **71**, to a second trunk line L8 at station **10'**. The two switches **44–1** and **44–2** are connected at one side to line L6, and at their opposite sides are connected to lines L7 and L8, respectively. Line L6 extends from foyer station **10'** to a terminal **73** located adjacent the two apartment stations represented by the buzzers **46–1** and **46–2**, respectively. The terminal **73** is connected through diodes **74** and **75** to the buzzers **46–1** and **46–2**, respectively.

Similarly the switches **44–3** and **44–4** are connected at one side to a line L6–1, and at their opposite sides are connected, respectively, to the lines L7 and L8. The line L6–1 extends from foyer station **10'** to a terminal **76** located adjacent the apartment stations represented by the buzzers **46–3** and **46–4**, respectively. Contact **76** is connected through diodes **77** and **78**, respectively, with buzzers **46–3** aNd **46–4**.

The diodes **70** and **71** are connected in opposition to one another with respect to the terminal T1, as are the diodes **74** and **75** with respect to their common terminal **73**. Similarly the diodes **77** and **78** are connected in opposition to one another with respect to the common terminal **76**. On the other hand, the diode **70** is oriented in the same direction as the diodes **74** and **77**, while the diode **71** is oriented in the same directions as the diodes **75** and **78**.

When the switch **44–1** or **44–3** is closed, diode **70** conducts only on the positive half cycle of the AC voltage appearing at terminal T1, thereby developing in line L6 or L6–1 a positive signal, depending on whether switch **44–1** or switch **44–3** is closed, which causes diode **74** or **77** to conduct to energize either buzzer **46–1** or **46–3**. During this period, the positive signal appearing on line L6 or L6–1 maintains the diode **75** or **78** non-conductive to prevent energization of buzzer **46–2** or **46–4**. As the potential on the terminal T1 grows negative, while the switch **44–1** or **44–3** is still closed, the diode **70** stops conducting, and blocks a negative signal from appearing on line L6 or L6–1, thus preventing energization of the associated buzzer **46–2** or **46–4**.

On the other hand if either switch **44–2** or **44–4** is closed, diode **71**, and hence diode **75** or **78**, would conduct only on the negative cycle of the AC voltage to energize either the buzzer **46–2** or **46–4**, depending on which of the associated switches is closed. If, for example, the switches **44–1** and **44–2** are closed simultaneously, the diodes **70** and **74** would conduct for one half cycle, and the diodes **71** and **75** would conduct for the other half, thereby alternately energizing buzzers **46–1** and **46–2**. Simultaneous closing of the switches **44–3** and **44–4** will in a like manner produce alternate energization of buzzers **46–3** and **46–4**, respectively. Thus, a single signal line L6 or L6–1 can be used selectively to control two different buzzers at two different apartments. As compared to the first embodiment (FIG. **1**), the system illustrated in FIG. **2** thus reduces by 50 percent the number of signal lines L6 that are necessary for operating the buzzers of a plurality of different apartments.

From the foregoing it will be apparent that the novel apartment house intercom and signalling systems disclosed herein considerably reduce the amount of wiring necessary to operate an intercom system as compared to prior such systems. It will be apparent, that if desired, the signalling system of FIG. **2** can be substituted for the corresponding signalling system illustrated in the first embodiment (FIG. **1**).

Having thus described my invention, what I claim is:

1. An intercom system for communicating selectively between a central station and one or more of a plurality of stations remote from said central station, comprising

a combination speaker-microphone unit at each of said stations,

a pair of conductors forming part of an audio signal circuit extending from said central station to each of said remote stations to convey audio signals from the unit at said central station to the unit at one of said remote stations, and vice versa,

an audio amplifier at said central station,

a direct current power supply for energizing said amplifier to enable transmission of audio signals therefrom,

a first plurality of switches normally disposed in first positions in which they connect the output of the speaker-microphone unit at the central station to the input of said amplifier, and the output of said amplifier to one of said conductors, and

a manually operable switch movable selectively to first and second positions, respectively, at each of said remote stations for selectively connecting the associated speaker-microphone unit between said pair of conductors for energization thereby,

said amplifier being operative, when the manually operable switch at one of said remote stations is in its first position, to transmit audio signals from said unit at said central station to the input of the unit at said one remote station,

means operative upon movement of the last-named switch to its second position to move the first-named plurality of switches to second positions in which they connect the output of the unit at said one remote station to the input of said amplifier, and connect the output of said amplifier to the input of said unit at said central station, and

a relay coil operative, when energized, to move said first-named plurality of switches to their second positions,

an electronic valve connected in series with said coil across said power supply and operative to block the flow of current through said coil, when the manually operable switch at each of said remote stations is in its first position, and

means operative, upon the movement of the manually operable switch at any one of said remote stations to its second position, to render said valve conductive, thereby to energize said coil,

a second relay coil connected at one end to the positive side of said power supply, and at its opposite end to said one conductor, and operative to control a circuit independent of the audio signal circuit,

a second, normally open, manually operable switch connected between said pair of conductors at each of said remote stations and operative upon being closed to energize said second coil, and

means for preventing energization of said second coil, when either of the first-named manually operable switches is in either its first or second operative position, and said second manually operable switch is open.

2. An intercom system for communicating selectively between a central station and one or more of a plurality of stations remote from said central station, comprising

a combination speaker-microphone unit at each of said stations,

a pair of conductors forming part of an audio signal circuit extending from said central station to each of said remote stations to convey audio signals from the unit at said central station to the unit at one of said remote stations, and vice versa,

an audio amplifier at said central station,

a direct current power supply for energizing said amplifier to enable transmission of audio signals therefrom,

a first plurality of switches normally disposed in first positions in which they connect the output of the speaker-microphone unit at the central station to the input of said amplifier, and the output of said amplifier to one of said conductors, and

a manually operable switch movable selectively to first and second positions, respectively, at each of said remote stations for selectively connecting the associated speaker-microphone unit between said pair of conductors for energization thereby,

said amplifier being operative, when the manually operable switch at one of said remote stations is in its first position, to transmit audio signals from said unit at said central station to the input of the unit at said one remote station,

means operative upon movement of the last-named switch to its second position to move the first-named plurality of switches to second positions in which they connect the output of the unit at said one remote station to the input of said amplifier, and connect the output of said amplifier to the input of said unit at said central station,

electrically operable signal means at each of said remote stations,

a plurality of manually operable signal switches at said central station,

a further plurality of conductors extending between said central station and said remote stations, each of said further conductors connecting one of said signal switches to the signal means at one of said remote stations, and

means operative, when said one signal switch is closed, to energize the associated signal means,

each of said further conductors being connected at one end at said central station to two of said signal switches, and at its opposite end to the signal means at two different remote stations, and

means operative, upon the closing of one of said two signal switches, to energize the signal means at one of said two stations, and operative upon the simultaneous closing of said two signal switches alternately to energize the associated signal means at said two remote stations.

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