Dec. 15, 1936. J. H. VOSS 2,064,186

INTERCOMMUNICATING SYSTEM

Filed Sept. 6, 1934 2 Sheets-Sheet 1

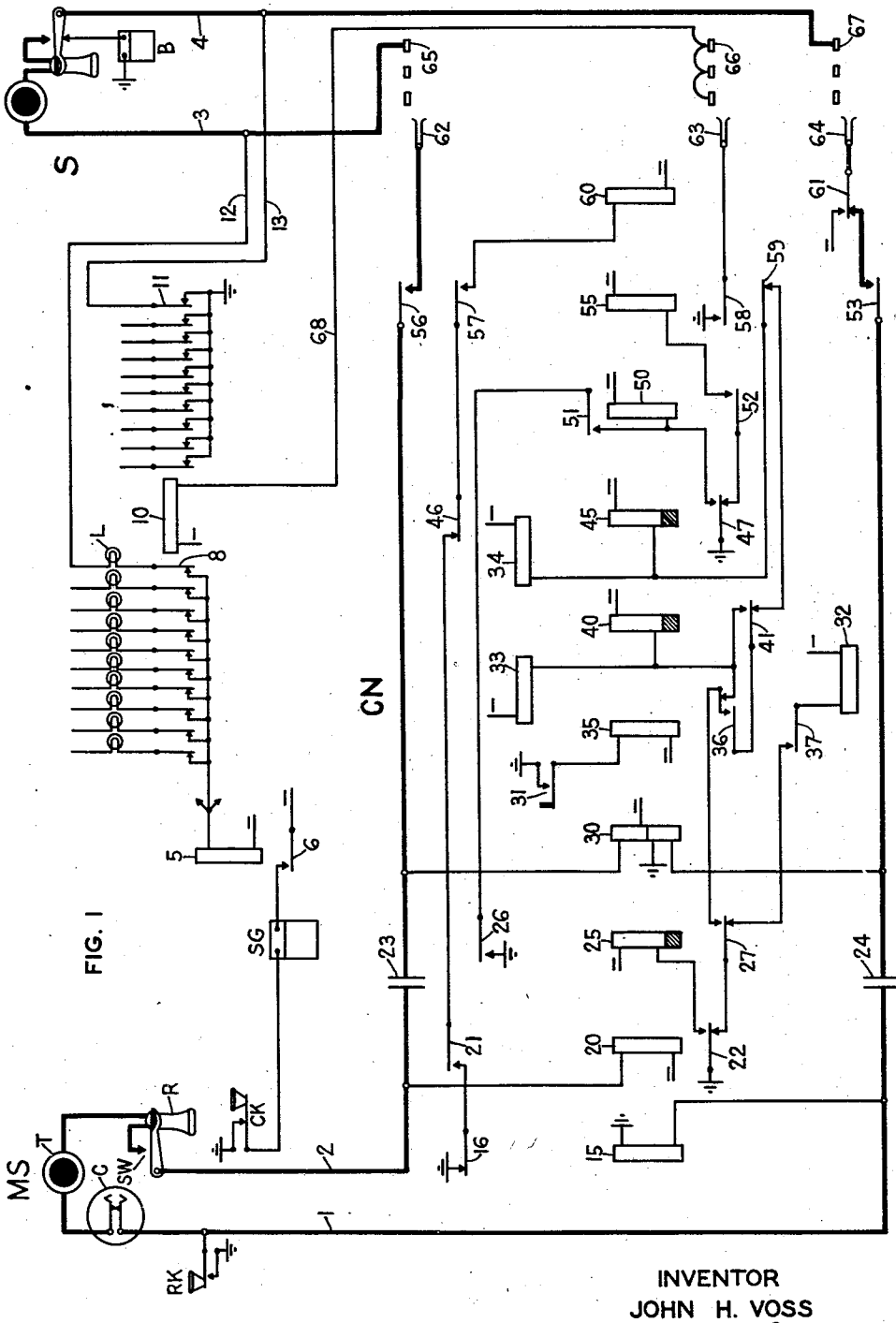



FIG. 1

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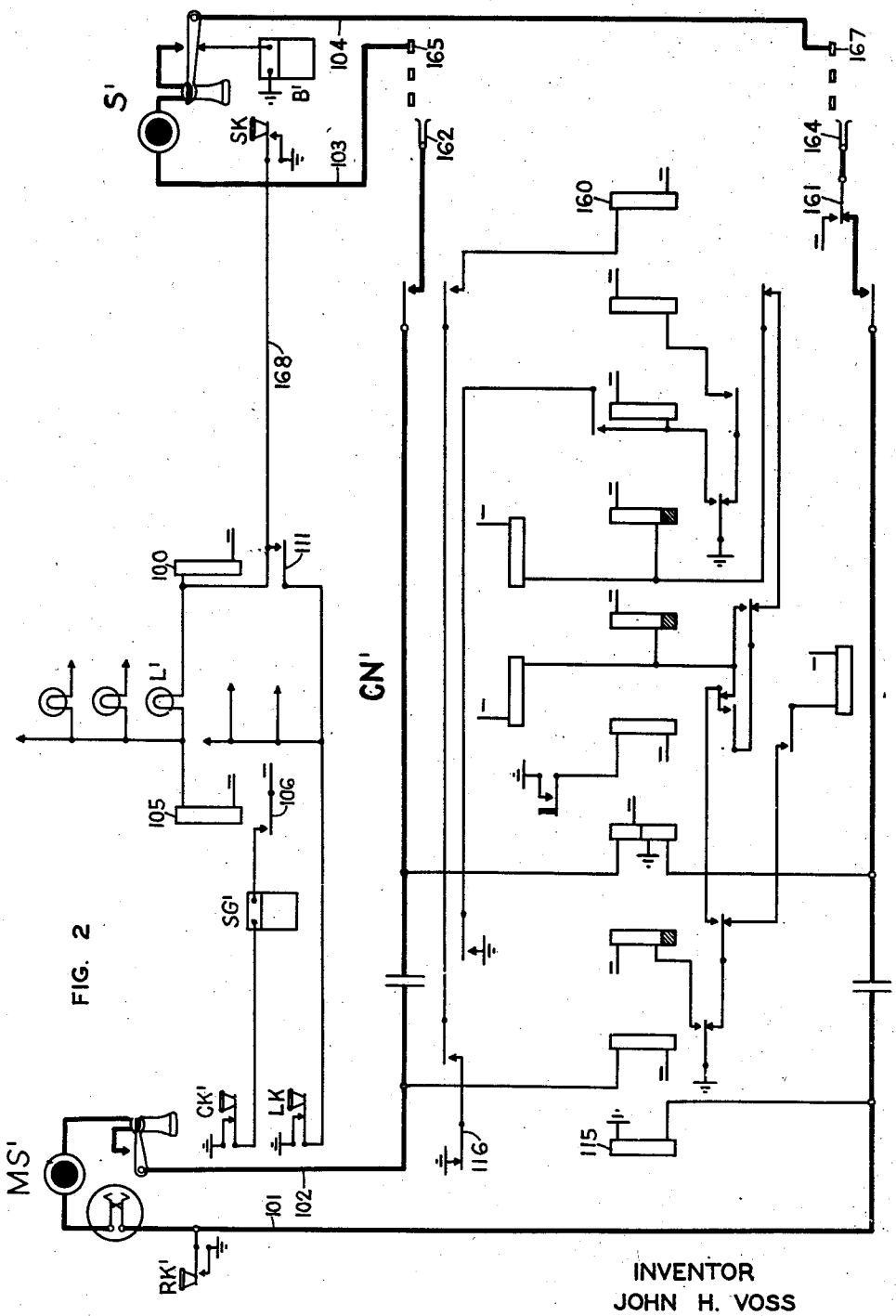



FIG. 2

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# UNITED STATES PATENT OFFICE

2,064,186

## INTERCOMMUNICATING SYSTEM

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Application September 6, 1934, Serial No. 742,902

11 Claims. (Cl. 179—18)

The present invention relates to improvements in intercommunicating telephone systems, and more particularly to new and improved circuit arrangements for small installations used in apartment houses, schools, hotels, factories, and other institutions.

The broad general object of the invention is to provide simple and economical means for establishing signalling and telephone connections between telephone stations of a small private telephone system.

A further object is to provide circuit arrangements for a system comprising a single master station and a group of outlying substations in which connections are established only between the outlying stations and the master station.

A feature of the invention is concerned with means whereby an outlying station may signal the master station and the master station will then dial the number of the calling outlying station over an automatic switch to establish the connection.

A further feature relates to an arrangement for providing a signal individual to each outlying station which is locked in operated condition upon the initiaton of a call whereupon the master station then calls the outlying calling station by means of the automatic switch.

A particular feature is directed to an arrangement in the automatic switch for signalling a wanted outlying station in which a key is provided at the master station which controls a relay in the switch to apply signalling current to the wanted station.

Additional features include the means for locking the master station signal in operated condition; means for locking the call signals of calling stations in operated condition after they have hung up, in case another outlying station is engaged in a connection with the master station, so the master station can subsequently call these outlying stations; means whereby a line relay per line is provided for controlling the call signals or alternatively a line relay for each group of ten lines may be provided in which event the other lines of the group would be inoperative when one line of the group is calling.

The above objects and features together with others not specifically pointed out will be more fully disclosed in the following detailed description which together with the drawings constitutes preferred embodiments of the invention. In the drawings Fig. 1 shows the circuit connections between a master station and outlying stations each having a single line relay; Fig. 2 shows a modification with similar circuit connections except that a single line relay is provided for each group of ten outlying stations.

It will be assumed that the system is to be used in an apartment building comprising a hundred stations, although other applications are readily apparent. In this event, referring to Fig. 1, the master station designated MS will be the telephone situated at the janitor's premises, while the outlying stations, one of which is shown as S, are situated in the various apartments of the building and are each connected by a pair of line conductors 3 and 4 with the switching equipment. The switching equipment consists of the connector switch CN, which is of the well known Strowger type of switch in which a set of wipers are mounted on a shaft that is stepped vertically and then rotary under control of dial impulses to position the wipers upon one of a hundred sets of bank contacts. The mechanical construction of this switch is well known and need not further be described, except the circuit arrangement. In the modification of Fig. 1 the outlying stations are divided into groups with ten stations in each group. A lamp such as lamp L is provided for each station in the system and these are arranged in a position so they are all visible from the master station MS. The lamps of each group of ten stations are controlled by a cut-off relay 10.

The janitor at master station MS desiring to establish a connection with the outlying station S whose number is 13, removes the receiver R at his telephone, thereby permitting the switchhook contacts SW to close and complete the line loop circuit through the transmitter T, calling device C and the line conductors 1 and 2. The line conductors extend to the connector switch CN and terminate in line relays 15 and 20 to ground and battery, respectively; these relays thereupon energize and operate their armatures. At armature 16 relay 15 opens a point in the ringing circuit while at armature 21 relay 20 closes a point in this circuit. At front contact of the impulsing armature 22 relay 20 closes the circuit of slow release relay 25, which thereupon energizes and at armature 26 prepares a locking circuit for relay 50, while at front contact and armature 27 the vertical stepping circuit is prepared.

The janitor at the master station MS then manipulates his calling device C in accordance with the first digit of the outlying station's number which in this instance is 1. The line loop circuit including line conductors 1 and 2 and line relays 15 and 20 is thereby interrupted once, permitting these line relays to deenergize and

restore their armatures. Armature springs 16 and 21 fall back without effect. At the back contact of armature 22 ground is extended through armature 27 and its front contact, (relay 25 due to its slow acting feature remains energized during impulsing) closed contact of armature 36, through the winding of the vertical stepping magnet 33 to battery. Vertical magnet 33 energizes and moves the shaft carrying the wipers 62, 63 and 64 one step upward opposite the first level or row of bank contacts. A branch of the circuit for magnet 33 extends through the winding of slow release relay 40 to battery and this relay upon energizing closes its front contact on armature 41 to prepare a locking circuit for itself should additional impulses be received. The instant the shaft carrying the wipers is raised the off-normal contacts 31 are closed and complete an obvious circuit for relay 35 which thereupon energizes and operates its armature 36 to its front contact and completes an alternative circuit for subsequent impulses to flow over. If additional impulses other than the single one mentioned are received they follow a circuit path from armatures 22, 27, front contact and armature 36, armature and front contact 41 to vertical magnet 33. Relay 40 remains energized until the end of the impulse or series of impulses, whereupon it falls back.

The janitor at master station MS dials the second digit 3 of the outlying station's number, resulting in line relays 15 and 20 falling away three times, and transmitting impulses via armatures 22, 27, 36, 41 and its back contact, back contact and armature 59, through the winding of rotary stepping magnet 34 to battery. The stepping magnet 34 follows the impulses received over this circuit and rotates the wipers 62, 63, and 64 step by step onto the set of bank contacts 65, 66, and 67. A branch of the rotary stepping circuit extends to slow release relay 45 which energizes and at its armature 46 opens a point in the ringing circuit and at the front contact of its armature 47 completes an obvious circuit for relay 50. Relay 50 upon energizing closes a locking circuit through its front contact and armature 51 to ground at armature 26 and at armature 52 prepares the circuit of switching relay 55.

After the three impulses have been transmitted and the wipers have been positioned as pointed out, slow release relay 45 deenergizes and releases its armatures 46 and 47. At the back contact and armature 47 a circuit is completed via armature 52 and its front contact for the switching relay 55, which upon energizing at armature 59 and its back contact opens the rotary stepping circuit to prevent further impulses from affecting the switch and at armature 57 and its front contact closes a point in the circuit of ringing relay 60. The armature 58 and its front contact are adjusted so they will close a short time before armatures 56 and 53 for a reason which will be pointed out. Ground potential is extended from armature 58 and its front contact, through wiper 63, bank contact 66 upon which it is now resting, conductor 68, through the winding of cut-off relay 10 to battery. The cut-off relay 10 is common to a group of ten lines or outlying stations of which the station S is one, and upon being operated opens its back contact from its armatures such as 8 and 11 to disconnect the station lamps of the group to prevent the stations from signalling the master station at the time it is engaged in making a call to station S or any other station in this group. The signalling conductors 12 and 13 of station S as well as the other stations are disconnected by relay 10.

As a result of the closing of armature springs 56 and 53 onto their front contacts by switching relay 55, the talking line conductors 1 and 2 from the master station are connected directly through to the line conductors 3 and 4 over the wipers and bank contacts of the switch CN. In order now for the master station MS to signal outlying station S the ringing key RK is operated and this connects ground potential to the line conductor 1 extending to line relay 15 which is thereby short circuited and consequently deenergizes but line relay 20 remains energized. Line relay 15 upon falling away closes its armature 16 onto its back contact to connect ground potential through front contact and armature 21, back contact and armature 46, armature 57 and its front contact through the winding of ringing relay 60 to battery. Ringing relay 60, upon energizing, closes battery potential from its front contact to its armature 61 over wiper 64 and bank contact 67, line conductor 4, switchhook contacts of the station S to ground, through the signal B, which thereupon operates to audibly call the attention of the occupant of the apartment that the janitor wishes to talk to him on the telephone. When the person at station S answers by removing his receiver from the switchhook, the key RK at the master station is released, resulting in the energization of line relay 15 again and the interruption of the circuit of ringing relay 60 at armature 16. Relay 60 upon falling away disconnects the signalling current at armature 61 and the connection is now in talking condition with line relays 15 and 20 feeding talking battery to the master station MS and coil 30 feeding talking battery to the outlying substation S, the two current sources being separated by the condensers 23 and 24. Relays 25, 35, 50, and 55 also remain energized for the duration of the connection.

It will be remembered that when switching relay 55 energized it closed its contacts and armature 58 first before it operated armatures 56 and 53. This was to insure that cut-off relay 10 was operated to open armatures 8 and 11 before the line was connected through to the bank contacts and line conductors 3 and 4, so that in case the ringing key RK was operated at the time the wipers reached the proper bank contacts, the ringing potential applied by relay 60 would not be short circuited over conductor 13 to the ground at armature 11.

When the connection is to be released the master station MS replaces the receiver R upon switchhook SW thereby interrupting the line loop circuit over conductors 1 and 2 and permitting relays 15 and 20 to deenergize. At armature 22 the circuit for relay 25 is opened and it slowly restores its armature 26, opening the locking circuit of relay 50 which in turn falls back and restores armature 52 thereby opening the energizing circuit of switching relay 55. Relay 55 opens the line circuit at armatures 56 and 53 and at armature 58 disconnects ground from the circuit of cut-off relay 10 so that upon deenergizing it restores its armatures 8 and 11 to their back contacts in order to place the station S and the others in its group in normal position.

As a further result of the deenergization of slow relay 25 and the restoration of its armature 27, ground potential is projected from armature 22 and its back contact, armature 27 and its back contact, front contact and armature 37, through the winding of release magnet 32 to battery. The

release magnet 32 upon energizing withdraws the holding pawl from the switch shaft as is well known, and permits the shaft carrying the wipers 62, 63, and 64 to restore to normal. An instant before it reaches normal position the off-normal springs 31 are opened by the shaft, thereby opening the circuit of relay 35 which in turn at armature 37 interrupts the circuit of release magnet 32. The switch CN as well as the master station MS and outlying station S are now in their normal condition.

Assume now that the outlying station S wishes to establish a connection with the master station MS. In this event the removal of the receiver at the station S completes a circuit extending from ground at back contact and armature 11, conductor 13, line conductor 4, through the telephone S, line conductor 3, conductor 12, through line lamp L, armature 8 and its back contact, through the common relay 5 to battery. The lamp L which is individual to the station S is illuminated in this circuit to call the attention of the person at the master station of the existence of a call. The energization of common relay 5 closes its armature 6 onto its front contact to complete the circuit of audible signal SG by way of key CK, to further signal the master station.

The person at the master station in responding to the call first operates key CK, which may be of the locking type, and thereby disconnect the audible signal SG. The number of the lamp L is then noted after which the receiver at the master station is removed and the user of the telephone then proceeds to dial the number of the calling station S which in this case is 13. The switch CN operates in the same manner as has been previously explained to position the wipers 62, 63, and 64 upon bank contacts 65, 66, and 67, respectively, leading to the line conductors 3 and 4 of the calling station. The cut-off relay 10 is likewise operated by switch CN and at armatures 8 and 11 disconnects the circuit for station lamp L as well as relay 5. At the same time this relay at its other armature disconnects the station lamps from the nine other stations in the same group to prevent them from calling in at this time and until station S has hung up. This will not, however, prevent stations in other groups from calling in and their individual lamps will remain lighted under control of their group cut-off relay such as 10 until the calls can be taken care of by the master station or until the calling station hangs up when the lamp goes out. The relay 5 is common to all group cut-off relays and will therefore further and audibly inform the master station of the waiting calls provided the key CK is not locked operated to disconnect signal SG which may be desirable at times. Conversation between the master station and the calling outlying station may now proceed until the master station hangs up to release the switch CN, whereupon relay 10 deenergizes and restores its armatures so that if additional stations in the same group are calling their individual calling lamps will immediately be illuminated to signal the master station. It wll be understood, of course, that while the individual signals for the stations have been shown as lamps, other visible signals such as annunciators, drops, etc., may be used.

Referring now to the modification shown in Fig. 2, the connector switch CN' and its circuit are similar to that of Fig. 1 except that no third wiper is provided. The master station MS' has an additional key LK while each of the outlying stations S' is provided with a signalling key SK. A relay 100 and lamp L' is individual to each outlying station and relay 105 is common to all the lamps L' in the system. In initiating a call in this type of system the master station MS' closes the line loop circuit comprising conductors 101 and 102 in the usual manner by removing the receiver, and then dials the number of the wanted outlying station to operate the switch CN' in the manner previously explained. Wipers 162 and 164 are thereby placed into engagement with bank contacts 165 and 167, respectively, and the connection extended over line conductors 103 and 104 to the wanted station S'. In order to signal the wanted station the key RK' is operated as before to drop back line relay 115 which in turn closes the circuit of relay 160 to project ringing current at its armature 161 over line conductor 104, through the switchhook contacts to the audible signal B' to signal the telephone S'. When the substation S' answers, the connection is completed for talking purposes, and when the master station hangs up the release of the connection and the switch CN' is effected in the manner as has been pointed out.

When the person in the apartment containing the station S' desires to call the janitor at the master station MS', the receiver at the station S' may or may not be first removed from the switchhook; but in either event the key SK must be operated and this connects ground potential to conductor 168 individual to the telephone S', through the winding of relay 100 to battery. Relay 100 which is individual to station S' energizes and at its front contact and armature 111 completes a locking circuit to ground at the key LK at the master station MS'. This key LK is common to all relays 100 in the system and controls the locking circuit of these relays when they are energized. A branch of the energizing circuit of relay 100 including conductor 168 extends through the signal lamp L' and relay 105 to battery. The lamp L' is associated with station S' and its illumination indicates to the master station MS' that the station S' is calling, and this lamp together with all other station lamps in the system are arranged so as to be easily visible to the janitor at the master station. The relay 105 which energizes with the illumination of the station lamp is common to all the lamps in the system and has its circuit closed each time a station call is made. At its front contact and armature 106 it closes an obvious circuit for the master station audible signal SG' to the key CK' at this station, which is a signal in addition to the lamp L' to call the janitor's attention to the call in case he is not in the immediate vicinity of the lamp panel.

From the foregoing it will be noted that whenever an outgoing station calls the master station its signal lamp is locked in operated position by its individual relay 100 and under control of the key LK at the master station. With this arrangement should other stations in the system be calling at a time when the master station is engaged in a call with one of the stations, these other stations may temporarily abandon the call, but their individual lamp signals will be illuminated at the master station to call his attention to the existence of the waiting call and after having disposed of the call in which he is engaged, can immediately call these waiting stations. Similarly when the janitor is engaged in duties away from the master station he can subsequently and upon his return note the station lamps which were illuminated and which remain

so during his absence, and immediately call these stations to inquire their wishes. This is of great advantage as it permits occupants of the apartments to engage in other activities instead of continually calling the janitor until he answers. The key SK is merely operated and the person waits until he is called by the janitor.

Returning now to where the master station MS' is signalled by the calling station S'. The first action of the janitor in responding to the call is to operate the locking key CK' which disconnects the operation of the audible signal SK'. He then operates his calling device in accordance with the number of calling station as noted by the illuminated lamp L' and operates the switch CN' to step its wipers into engagement with the calling station's line. If the person at station S' has his receiver removed the connection is immediately established, but if this is not so the janitor must operate ringing key RK' which as has been explained controls line relay 115 to operate ringing relay 160 and project ringing current to the signal B' at the calling station S' until this station answers. After the connection between the two stations has been established the janitor at the master station may operate his key LK; this opens the locking circuit of relay 100 through its contacts 111 and it deenergizes. The branch of this circuit extending through the illuminated lamp L' and relay 105 is also interrupted and they are disconnected. At contacts 106 relay 105 opens a further point in the circuit of the signal SG' which has previously been disconnected by locking key CK'. If other stations, however, have been calling their individual lamps will be lighted and relay 105 remains energized at this time. If the key LK is not operated, all the signal lamps L' remain operated even though the call for the associated station has been answered. After all calls are answered the key LK can be operated to remove the locking ground from all the relays such as 100 and disconnect the lighted signals.

While the invention has been described in certain specific forms, it will be understood that many changes and additional modifications may be made without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. In a telephone system, a master station and a plurality of outlying stations, a signal for each of said outlying stations at said master station operated when a station calls the master station, an automatic switch connected to said master station, means controlled at said master station in response to a call for operating said automatic switch to connect said master station with the calling outlying station, and means automatically responsive to the establishment of said connection for disconnecting the signal of the calling outlying station.

2. In a telephone system, a master station and a plurality of outlying stations, a signal individual to each outlying station at said master station, and operated by the associated outlying station to signal the master station, an automatic switch associated with said master station and operated under control of said master station to connect the master station with the calling outlying station and to disconnect the calling signal, and means controlled by said master station over said connection for signalling the calling outlying station.

3. In an intercommunicating telephone system, a master station and a plurality of outlying stations, a signal at said master station for each of said outlying stations operated by the associated outlying station upon the initiation of a call, an automatic switch associated with said master station operated by said master station in response to the call to establish a connection between the master station and the calling outlying station and to effect the disconnection of the calling signal, and a signal key at said master station operated to control said automatic switch to signal the calling outlying station over said established connection.

4. In an intercommunicating telephone system, a master station and a plurality of outlying stations, a signal at said master station for each of said outlying stations operated by a calling outlying station, said signals divided into groups, an automatic switch associated with said master station operated under control of said master station to establish a connection with the calling outlying station, means in said automatic switch for disconnecting the operated calling signal and all other signals in the same group, and means at said master station for signalling said calling outlying station over said established connection including said automatic switch.

5. In an intercommunicating system, a master station and a plurality of outlying stations, a signal at said master station for each of said outlying stations and operated by an associated outlying station in calling the master station, said signals divided into a number of groups, an automatic switch associated with said master station controlled thereby to connect it with the calling outlying station, means in said automatic switch responsive to said connection for disconnecting the calling signal and all the other signals in the same group to prevent said other signals from being operated at this time, the other group of signals being operable in case their associated outlying stations are calling, and means at said master station controlled over said automatic switch for signalling the calling outlying station.

6. In a telephone system, a master station and a plurality of outlying stations, a signal individual to each outlying station at said master station and operated when a call by said outlying station is made, said signals divided into groups and each group controlled by a cut-off relay, an automatic switch associated with said master station and operated thereby in response to a call to connect the master station with the calling outlying station, means in said switch responsive to said connection for operating the cut-off relay of the group of signals associated with the calling signal to disconnect all signals of the group including the calling signal, the signals of other groups being operable as their associated outlying stations initiate the calls, and means at said master station for connecting with the calling outlying stations of the group in turn and for signalling them over said connections.

7. In a telephone system, a master station and an outlying station, an automatic switch for establishing connections between said stations, a pair of line relays and a ringing relay in said switch, said line relays controlled from said master station to operate said switch into connection with said outlying station, means at said master station for deenergizing one of said line relays to operate said ringing relay, and means controlled by said ringing relay for signalling said outlying station over said connection.

8. In a telephone system, a master station and a plurality of outlying stations, a signal for each station at said master station, means at any out-

lying station in calling the master station for operating its signal into locked position, and means at said master station in responding to the call for unlocking the operated signal.

9. In a telephone system, a master station and a plurality of outlying stations, a signal for each outlying station at the master station, means at all outlying stations in initiating a call to the master station for operating their associated signals, means controlled by said master station for establishing connections with said calling stations one at a time, and means at said master station for releasing the operated signals of the calling stations one at a time as they are connected with.

10. In a telephone system, a master station and a plurality of outlying stations, a signal and a locking relay therefore at said master station for each of said outlying stations operated by their associated outlying stations in calling the master station, means at said master station in responding to the calling signal for unlocking said relay and disconnecting said signal, said means at the master station operated each time a calling signal is to be disconnected, said operated signals remaining locked in operated position until answered in turn, means at said master station for setting up a connection with the calling outlying stations in turn as their calling signals are answered, and means at said master station for signalling said calling outlying stations.

11. In a telephone system, a master station and a plurality of outlying stations, a locking relay and a signal controlled thereby individual to each outlying station at said master station, a key at each outlying station operated in calling the master station to energize said locking relay and operate the station signal so said signal remains operated after said key is released, a releasing key at said master station operated to release said locking relay and disconnect the operated signal, an automatic switch associated with said master station and operated thereby in response to a station signal to establish a connection with the calling outlying station, and a ringing key at said master station for signalling said calling station over said automatic switch and connection.

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