Nov. 24, 1942. W. M. BEAUMONT 2,303,015

EMERGENCY CONFERENCE CIRCUIT

Filed Sept. 27, 1941 4 Sheets-Sheet 1

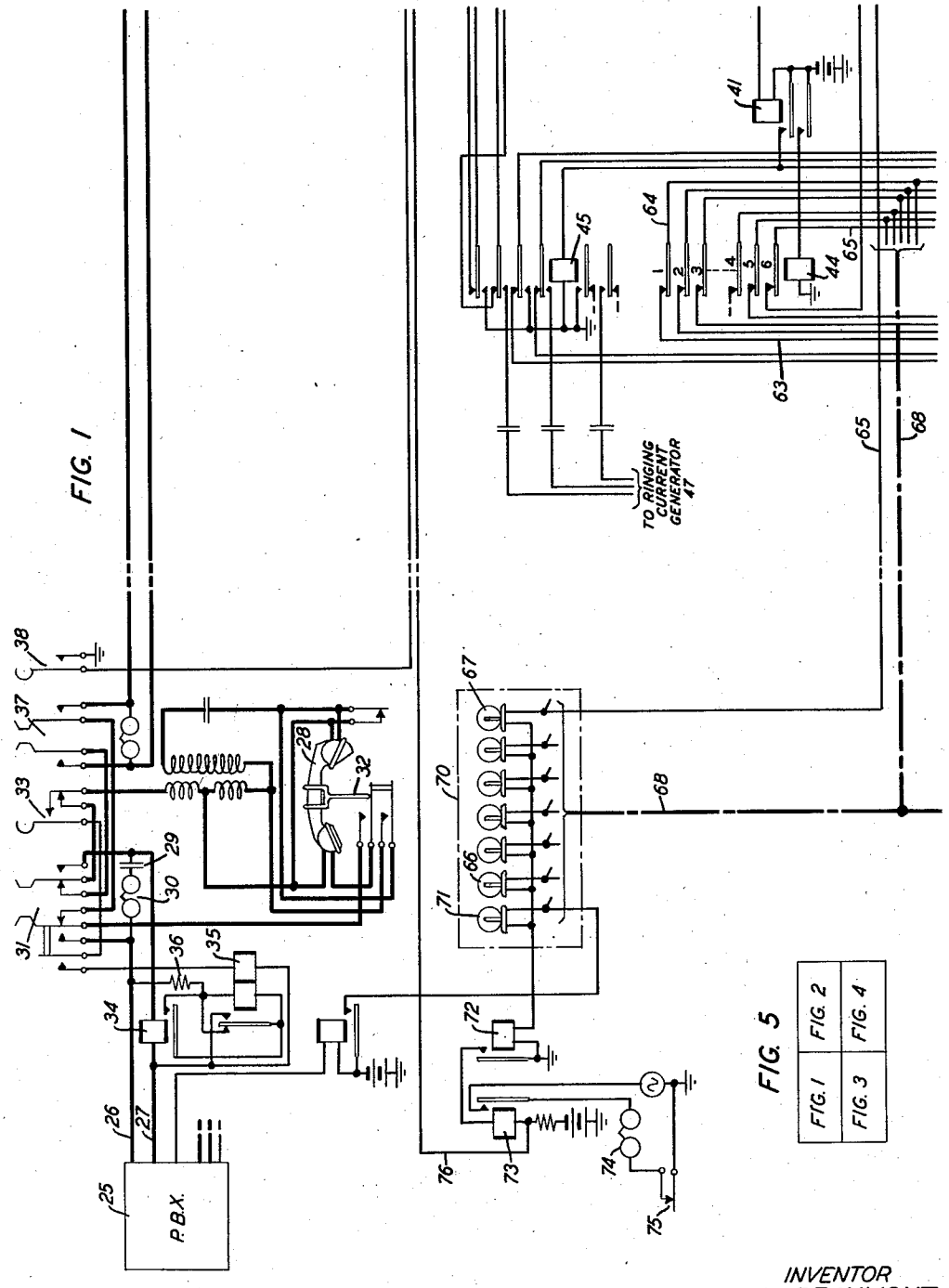

FIG. 1

FIG. 5

FIG. 1	FIG. 2
FIG. 3	FIG. 4

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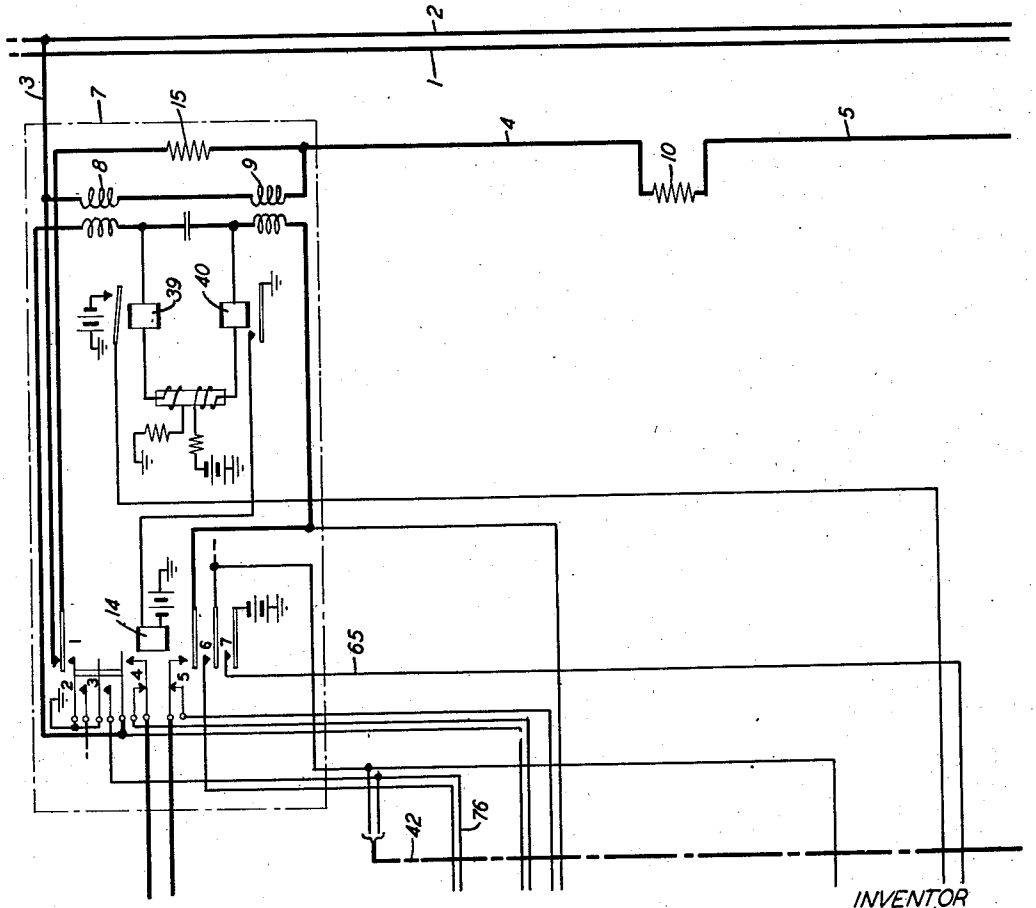
FIG. 2



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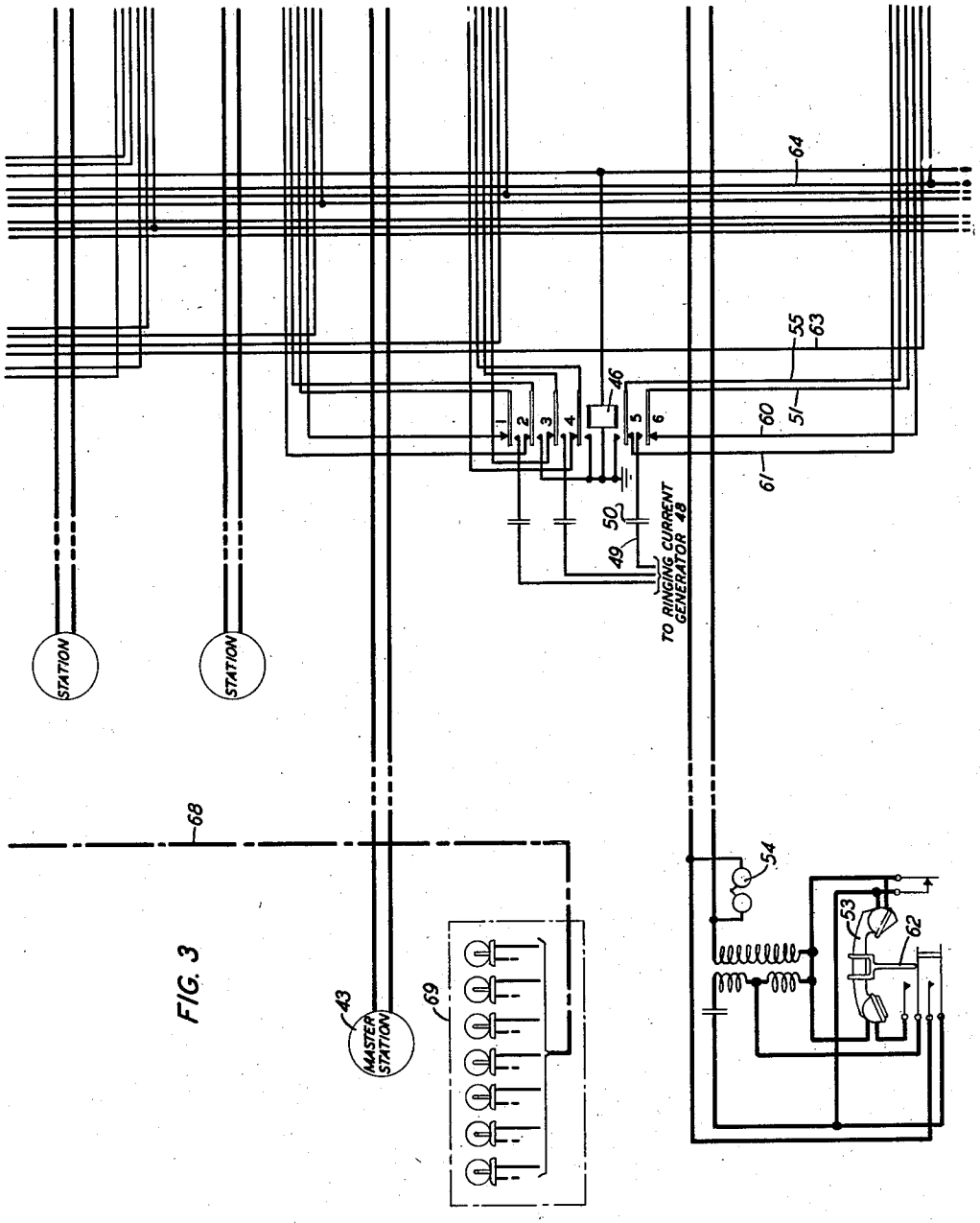

FIG. 3

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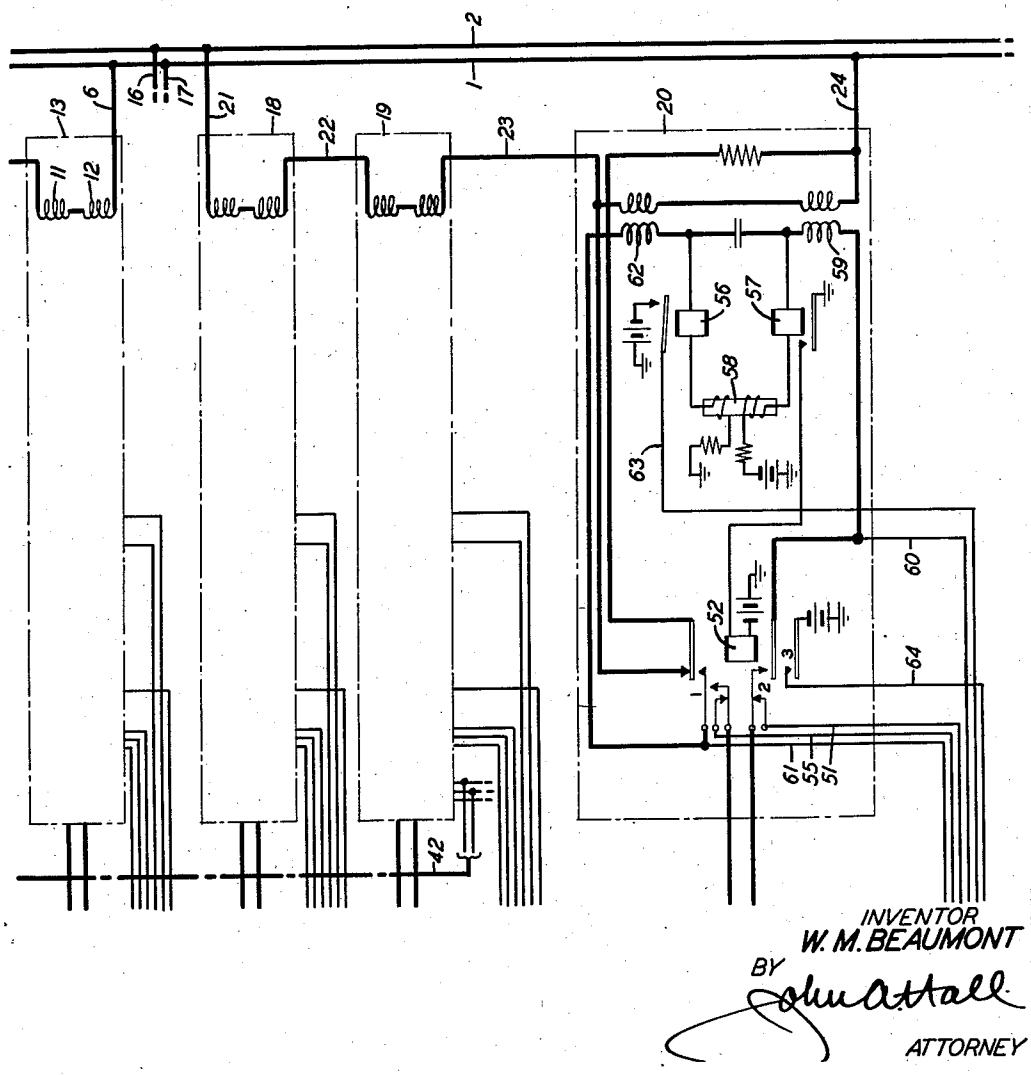
FIG. 4



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Patented Nov. 24, 1942

2,303,015

UNITED STATES PATENT OFFICE

2,303,015

EMERGENCY CONFERENCE CIRCUIT

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Application September 27, 1941, Serial No. 412,555

6 Claims. (Cl. 179—18)

This invention relates to communication systems and particularly to emergency telephone conference systems whereby a plurality of telephone stations may be summoned swiftly.

The system is based on a conference circuit controlled by one or more master stations. Such a station may by a simple switching operation connect to the conference circuit and summon every other station associated with such circuit whether busy or idle. Each line is provided with a signal in view of each master station which performs the dual purpose of showing whether the party at that station has answered his summons and the fact that the line is or is not in proper condition. Each station as it answers associates itself with the conference circuit without disturbing the signaling condition set up for the remainder of the stations. Each station may leave the conference circuit and may be recalled without disturbing such circuit.

This invention is an improvement on the system disclosed in Patent No. 2,270,915, granted to Abbott et al.

A features of the invention is a conference circuit having branches leading to a plurality of master stations and a plurality of subordinate stations, any one of the said master stations having control to call all of the remaining stations.

Another feature of the invention is a ringing circuit for each station associated with the conference circuit wherein the usual condenser in the substation ringing circuit is replaced by a like condenser in the control circuit.

Still another feature is a signal or signals for each line located in view of the said master stations which will indicate both that the line is or is not in good condition and that the party on such line has or has not answered a call.

Another feature is a means for determining the meaning of the display of said signal. Since this signal responds both to an out of order condition and an answered call condition it may be important to know which of these conditions is being indicated. The master station may therefore operate his calling key and this will open the control over the signal in response to the out of order condition so that the signal is then responsive only to the answered call condition.

Other features will appear in the following description.

The drawings consist of four sheets of circuit diagram numbered respectively Figs. 1, 2, 3 and 4 which when arranged as indicated in Fig. 5 make a complete circuit diagram, schematic in certain details which will be pointed out hereinafter, of the invention.

In Figs. 2 and 4 the heavy conductors 1 and 2 indicate a communication channel here spoken of as a conference circuit. To this conference circuit there are connected in parallel a plurality of branches, each of which connects in series to three station circuits. A first branch comprises the conductor 3 connected to the conductor 2 and leading into the broken line rectangle 7 containing the line circuit for one station line circuit. The circuit from conductor 3 may be traced through primary coils 8 and 9 of a repeating coil to conductor 4. This branch may then be traced through the resistance 10 to conductor 5, thence through coils 11 and 12 of a repeating coil of another station line circuit represented by the broken line rectangle 13 to conductor 6 which connects to conductor 1 of the conference circuit. It will be noted that normally the coils 8 and 9 are shunted by a circuit from conductor 3, back contact and armature 1 of relay 14, resistance 15 to conductor 4, the purpose of this being to make the impedance of the line circuit equal at all times. When the substation connected to the line circuit 7 is idle, the loop then being for transmission purposes open, relay 14 will be unoperated as shown and the resistance 15 then substitutes for the condition established at other times. At such other times when the substation connected to the line circuit 7 is busy, then the circuit of resistance 15 will be opened. Thus means is provided to automatically maintain the effective impedance of the line circuit constant.

The resistance 10 is a pad to substitute for a line circuit which is not provided. The line circuit 13 is shown schematically, it being understood that means similar to the resistance pad 15 is also provided here.

Conductors 16 and 17 represent other groups of three line circuits also connected to the conference circuit conductors 2 and 1, respectively.

Another group of three line circuits connected to the conference circuit is represented by the three broken line rectangles 18, 19 and 20 and the conductors 21, 22, 23 and 24.

By this means a large number of stations may be simultaneously connected to the conference circuit and the transmission qualities thereof maintained at an even level regardless of the number which are effectively so connected at any time.

The station line circuits are in general of two

varieties, one known as a master station and the other as a called station. The transmission characteristics of the two are the same but the master station has certain switching facilities which are not provided at the ordinary stations. It should be noted that the master stations may be scattered at random among the outlets from the conference circuit. This is indicated by the fact that the station line circuits 7 and 19 are represented as leading to master stations while station line circuits 13, 18 and 20 lead to ordinary stations.

The circuit diagrams in full for one master station and for one ordinary station are shown while the remainder are indicated schematically.

It is contemplated in a system of this character that only the master stations will be connected into a private branch exchange and that the only function of the ordinary stations will be to participate in the conference circuit service. It will be understood, however, that by simple and well-known switching arrangements, similar to those employed at the master stations that private branch exchange service could also be given to any one or more of the ordinary stations.

The rectangle 25 in the upper left-hand corner of Fig. 1 represents a private branch exchange. A line represented by the conductors 26 and 27 leads therefrom to the master station here represented by the handset 28. Ringing current from the exchange will flow through the condenser 29 and the ringer 30 to summon the attendant at this master station. The call may be answered by the operation of the answering key 31, and the removal of the handset 28 from its cradle 32.

Let us suppose the call is one which involves the use of the conference circuit. The attendant at the master station will then momentarily operate the hold key 33. This will open the circuit for the supervisory relay 34 and close a circuit for the hold relay 35 which will then lock up and bridge the resistance 36 across the conductors 26 and 27 to hold the call to the exchange until the answering key 31 is again operated. The calling key 37 is then operated to connect the master station to its conference circuit connection instead of the line to the exchange and the ringing key 38 is operated.

The transmission circuit between the master station and the station line circuit being closed by the removal of the handset 28 from its cradle 32, both relays 39 and 40 will be operated. Relay 40 will cause the operation of relay 14 which will effectively connect the master station to the conference circuit. Upon the operation of the ringing key 38 a connection will be extended through the front contact and armature 6 of relay 14 to cause the operation of relay 41. It will be noted that through the multiple connection denoted by the broken line 42 the master station 43 may exercise the same control over relay 41. Relay 41 will cause the operation of relays 44 and a plurality of ringing relays such as 45 and 46. These ringing relays will connect a source of ringing current to each line associated with the conference circuit and thus simultaneously summon the attendants at such stations.

The ringing current generator 47 is indicated by a label. Three leads are indicated as being connected thereto since for certain practical reasons each lead is individually connected through a current limiting resistance. Similarly the ringing current generator 48 is indicated by a label. The lead 49 connects ringing current through a circuit which may be traced through the condenser 50, front contact and armature 6 of relay 46, conductor 51, normal contacts of armature 2 of relay 52 over the ring of the line leading to the ordinary station here designated by its handset 53, through the ringer 54 back over the tip of the line, through the normal contacts of armature 1 of relay 52, conductor 55, armature 5 and front contact of relay 46 to ground. Similar ringing circuits for each station associated with the conference circuit are established by the relays 45 and 46. In the case of the master station the ringing circuit is ineffective since relay 14 is operated. As soon as the attendant at the ordinary station designated by the handset 53 responds, both relays 56 and 57 respond and cause relay 52 in turn to respond, so that thereafter even though relay 46 is operated the described ringing circuit will be ineffective. Should the party having handset 53 answer during ringing, the ringing current would be heard by him but the instant it ceases, as by the release of key 38 and the deenergization of relay 46, then relay 57 will be energized and relay 52 in turn will cut off the ringing circuit. The circuit for relay 57 may be traced during the period of release of relay 41 from battery, the lower winding of impedance coil 58, winding of relay 57, coil 59 of the station line circuit repeating coil, conductor 60, back contact and armature 6 of relay 46, conductor 51, thence over the circuit previously traced to conductor 55, armature 5 and back contact of relay 46, conductor 61, coil 62 of the station line circuit repeating coil, winding of relay 56, upper winding of impedance coil 58 to ground. Since the low resistance of the station with the handset 53 now removed from its cradle 62 is now included in this circuit, relay 57 responds.

Similar circuits for each station provide means whereby as each station answers it is cut off from the ringing circuit and effectively connected to the conference circuit without interfering with the repeated operation of the ringing of the remaining unanswered stations.

It should be noted that the ringer 54 is bridged directly across the line and that it has no condenser in series with it as in the case of ringer 30. The equivalent condenser, however, appears as condenser 50 connected to conductor 49 so that the ringer 54 will be operated under exactly the same circuit conditions as ringer 30.

It should be further noted that the above arrangement provides what is termed as a continuous test feature. That is, a current will continuously flow over the loop of the station through the ringer 54 and both relay 56 and 57. Relay 56 is sensitive and will continuously respond to this small current, but relay 57 is marginal and will only respond when the current has been increased by the removal of the handset 53 from the cradle 62.

Relay 56 by having its armature continuously operated will keep battery disconnected from conductor 63. If, however, the loop to this station should be opened as by the line wires being broken or torn down in any manner, relay 56 would release and thereby connect battery to conductor 63, which may be traced through the back contact and armature 1 of relay 44 to conductor 64. This conductor, like conductor 65, leads to a signal lamp 66 individual to its station and placed in view of the attendant at the master station. Individual leads to these lamps are indicated by the single individual lead 65 to lamp 67 and the broken line 68 representing the remainder thereof. If there are other

master stations provided, as for instance, the master station 43, then a similar bank of lamps 69, multipled to the bank 70 by the conductors represented by the broken line 68 will be provided therefor.

These banks of signal lamps have one lamp for each station associated with the conference circuit. Another lamp, such as lamp 71, is provided for each exchange line.

Lamp 66 is associated with the station designated by the handset 53. If relay 56 releases, lamp 66 will respond. The lamp 66 lighted during a period when the conference circuit is not in use will indicate the associated line in trouble, and this condition being noted by the attendant at the master station will be properly reported and remedied.

These lamps also function during a conference call to indicate to the attendant at the master station which stations have answered. Assuming the line to the ordinary station designated by its handset 53 to be in good condition, then lamp 66 will be dark until this station answers. When this occurs relay 57 responds and relay 52 will place battery on conductor 64 through its armature 3 to light lamp 66.

It should be noted that if during a conference connection the attendant at the master station is in doubt regarding the meaning of the operation of lamp 66 he may determine this by operating key 38. If lamp 66 continues its indication this proves that it is operating under control of relay 57 which means that the party has answered (or that the line is otherwise in a low resistance condition). If, however, the lamp 66 goes out during the depression of key 38, it indicates that it was burning in response to the release of relay 56 and that the line is in trouble. This effect is due to the operation of relay 44 during the depression of key 38, since the control of lamp by relay 56 is through the contacts of relay 44 while the control of lamp 66 by relay 57 is direct.

An alarm circuit is provided. The ground for operating the signal lamps is obtained through the winding of relay 72. When any one or more lamps are operated, relay 72 responds and this causes the relay 73 in turn to respond and close a circuit for alarm ringer 74. The ringer 74 may be rendered ineffective by the operation of a key 75. The ringer 75 may also be rendered automatically ineffective during a conference call by the short-circuiting of the relay 73 over conductor 76 at the front contact and armature 3 of relay 14 or a multiple connection thereto at any other master station.

It should be noted that any master station may make a conference call, in which case all other master stations are operated in exactly the same manner as ordinary stations.

What is claimed is:

1. In a communication system, a conference circuit, a plurality of master stations and a plurality of subordinate stations associated with said circuit, means under control of each of said master stations for calling and for recalling all other stations associated with said circuit, a continuous test circuit for each of said stations comprising a direct current path bridged across the line at said station and a sensitive relay in the line at the said conference circuit, a signal in view of said master stations for each said station associated with said circuit responsive to said relay, said signal being also responsive to an answered call condition at said station, and means responsive to said calling and recalling means for determining to which of said two conditions said signal is responding.

2. In a communication system, a conference circuit, a plurality of master stations and a plurality of subordinate stations associated with said circuit, means under control of each of said master stations for calling and for recalling all other stations associated with said circuit, said means including a ringing key operable at said master station and a multicontact relay responsive thereto, said multicontact relay operating to connect a source of ringing current to a plurality of leads one for each station associated with said conference circuit, a continuous test circuit for each of said stations comprising a direct current path bridged across the line at said station and a sensitive relay in the line at the said conference circuit, a signal in view of said master stations for each said station associated with said circuit responsive to said relay, said signal being also responsive to an answered call condition at said station, and means responsive to said calling and recalling means for determining to which of said two conditions said signal is responding.

3. In a communication system, a conference circuit, a plurality of master stations and a plurality of subordinate stations associated with said circuit, means under control of each of said master stations for calling and for recalling all other stations associated with said circuit said means including a ringing key operable at said master station and a multicontact relay responsive thereto, said multicontact relay operating to connect a source of ringing current to a plurality of leads one for each station associated with said conference circuit, a condenser in each of said leads, a continuous test circuit for each of said stations comprising a ringer bridged across the line at said station and a sensitive relay in the line at the said conference circuit, a signal in view of said master stations for each said station associated with said circuit responsive to said relay, said signal being also responsive to an answered call condition at said station, and means responsive to said calling and recalling means for determining to which of said two conditions said signal is responding.

4. In a communication system, a conference circuit comprising a common path having a plurality of branches, a plurality of master stations and a plurality of subordinate stations associated with said conference circuit, one of said stations being connected to each of said branches, means under control of each of said master stations for calling and for recalling all other stations associated with said circuit, said means including a ringing key operable at said master station and a multicontact relay responsive thereto, said multicontact relay operating to connect a source of ringing current to a plurality of leads one for each said branch of said conference circuit, a continuous test circuit for each of said stations comprising a direct current path bridged across the line at said station and a sensitive relay in the line at the said conference circuit, a signal in view of said master stations for each said station associated with said circuit responsive to said relay, a marginal relay in the line at the said conference circuit responsive to an answered call condition at said station, said signal being also responsive to said marginal relay and means responsive to said calling and recalling means for determining to which of said two relays said signal is responding.

5. In a communication system, a conference circuit comprising a common path having a plurality of connections multipled thereto, each said connection including a plurality of primary transformer windings connected in series, each said transformer winding having a secondary winding connected to a conference circuit branch, a plurality of master stations and a plurality of subordinate stations associated with said conference circuit, one of said stations being connected to each of said branches, means under control of each of said master stations for calling and for recalling all other stations associated with said circuit, said means including a ringing key operable at said master station and a multicontact relay responsive thereto, said multicontact relay operating to connect a source of ringing current to a plurality of leads one for each said branch of said conference circuit, a continuous test circuit for each of said stations comprising a direct current path bridged across the line at said station and a sensitive relay in the line at the said conference circuit, a signal in view of said master stations for each said station associated with said circuit responsive to said relay, a marginal relay in the line at the said conference circuit responsive to an answered call condition at said station, said signal being also responsive to said marginal relay and means responsive to said calling and recalling means for determining to which of said two relays said signal is responding.

6. In a communication system, a conference circuit comprising a common path having a plurality of connections multipled thereto, each said connection including a plurality of primary transformer windings connected in series, each said transformer winding having a secondary winding connected to a conference circuit branch, a plurality of master stations and a plurality of subordinate stations associated with said conference circuit, one of said stations being connected to each of said branches, means under control of each of said master stations for calling and for recalling all other stations associated with said circuit, said means including a ringing key operable at said master station and a multicontact relay responsive thereto, said multicontact relay operating to connect a source of ringing current to a plurality of leads one for each said branch of said conference circuit, a continuous test circuit for each of said stations comprising a direct current path bridged across the line at said station and a sensitive relay in the line at the said conference circuit, a signal in view of said master stations for each said station associated with said circuit responsive to said relay, a marginal relay in the line at the said conference circuit responsive to an answered call condition at said station, an impedance element controlled by said marginal relay for connection in bridge of said primary transformer winding whereby the effective impedance of said conference circuit is equalized by the response of said marginal relay to an answered call condition at said station, said signal being also responsive to said marginal relay and means responsive to said calling and recalling means for determining to which of said two relays said signal is responding.

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