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AUTOMATIC INTERCOMMUNICATING TELEPHONE SYSTEM

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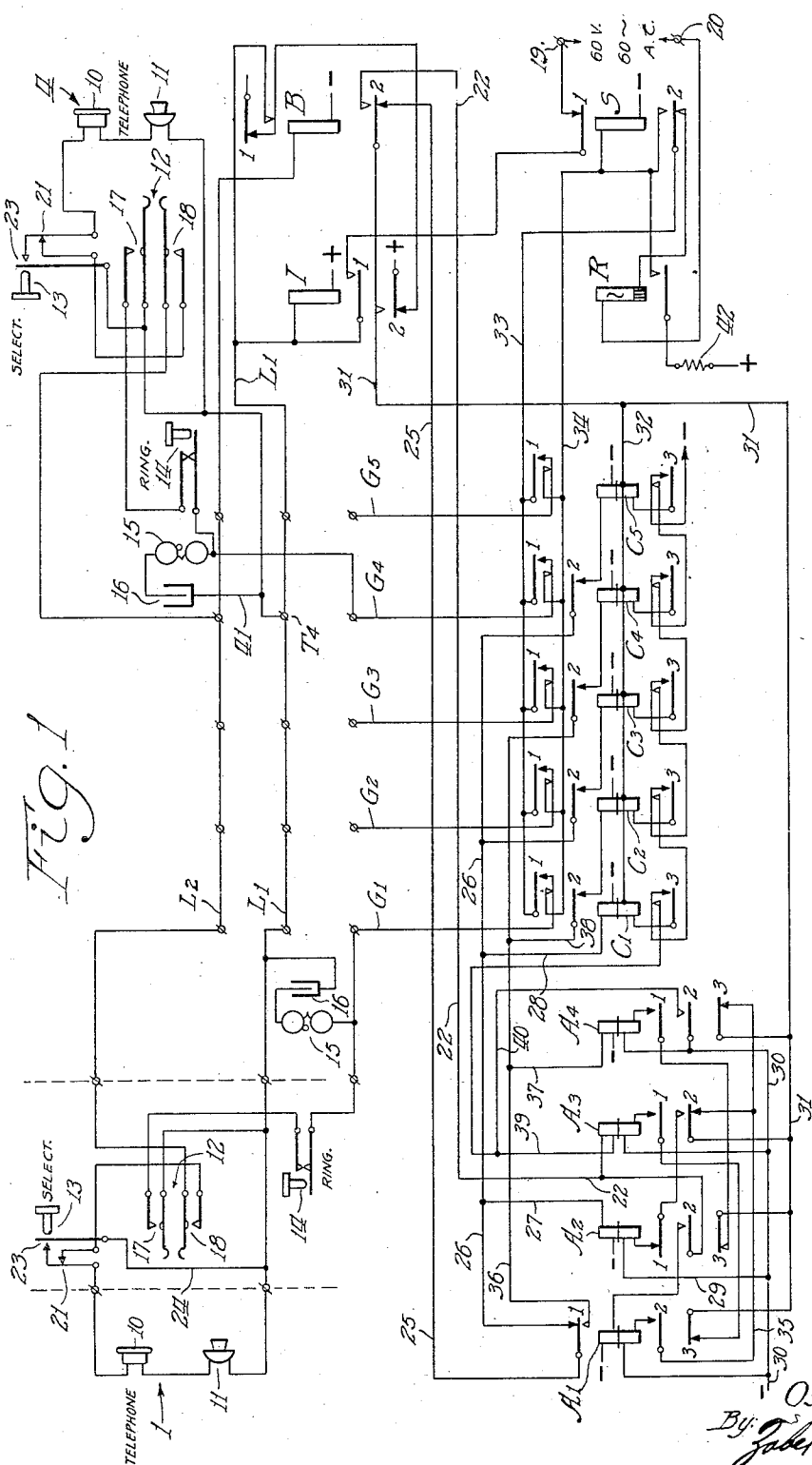
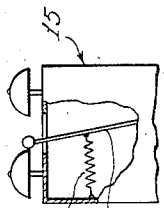


Fig. 2

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UNITED STATES PATENT OFFICE

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AUTOMATIC INTERCOMMUNICATING
TELEPHONE SYSTEMOscar M. Leich, Genoa, Ill., assignor to Leich
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9 Claims. (Cl. 179-16)

My invention relates to automatic intercom-
municating telephone systems, and has for its
principal object the provision of a system of this
character which permits the operator of any one
of several telephones to select and talk to any
other one of the group with utilization of only at
the most three line connections for each tele-
phone two of which connections are common to
all telephones.

It is also a purpose of my invention to provide
a system of this character which gives to tele-
phones of the system full selective ringing of the
others by means of a pair of push buttons at each
telephone.

It is also an object of this invention to provide
a system of this character in which the number
of telephones on the system can be increased
or decreased without changing the equipment at
each telephone and with the addition or removal
of very little equipment at the central station.

Other and more specific objects and advantages
of the invention will appear as the description
proceeds in connection with the accompanying
drawing wherein the preferred form of the in-
vention is shown. It is to be understood, how-
ever, that the drawing and description are illus-
trative only and are not to be taken as limiting
the invention except in so far as it is limited by
the claims.

In the drawing—

Fig. 1 is a diagrammatic view of the system;
and

Fig. 2 is a small view illustrating the application
of a biasing spring to the ringing bell.

Referring now in detail to the drawing, I have
shown my invention as applied to a system in-
cluding five telephones of which only two, Nos.
1 and 4, are shown. Since the equipment at all
telephones is the same, it is believed that this will
be sufficient to enable one to understand the
operation of the system. At each telephone there
is a receiver 10 and a transmitter 11 connected
in series across the line wires L1 and L2 to hook
switch 12. There is also at each telephone a se-
lecting key 13 and a ringing key 14 together with
a bell 15, and in series with the bell is a small
condenser 16 which may be of about one half
mf. capacity. Lines L1 and L2 are common to
all telephones, and each individual telephone is
provided with a third line G so I have shown five
of these lines, G1 to G5.

Hook switch 12 is so arranged as to close its
upper contact 17 before closing contact 18 in all
the telephones.

Referring now to the operating equipment, al-

ternating current for ringing is applied at sixty
volts through the terminals 19 and 20. Direct
current from the battery is utilized for operating
and talking. The battery is not shown, but the
appropriate polarity has been shown by the usual
positive and negative signs wherever battery con-
nections are made. The operating relays B, S,
and I are operated from the telephone initiating
the call. These relays in turn control the oper-
ation of the four relays A1 to A4 in conjunction
with the individual line relays C1 to C5 inclusive.
Relay R is an alternating current relay. All of
the equipment is shown at rest which is the posi-
tion when no call is taking place.

It is believed that the operation of the system
will be best understood by describing in detail the
steps that take place when a call is made from
one station to another.

We will assume that telephone 1 is initiating a
call. Lifting of this telephone from its base closes
the two hook switch contacts 17 and 18 which
provides the following operating circuit for re-
lays B, I, and S: An energizing circuit for relay
B is connected from negative battery through the
50 ohm winding of B relay to line L2 and over
this line conductor through the lower hook switch
contact 18 and through lower contact 21 on a
selecting key 13, through the hand set receiver
10 and transmitter 11 to the line L1 and over this
line conductor to the 25 ohm winding of I relay
to positive battery. Also, relay S is energized
over a circuit extending from negative battery
through the 150 ohm winding of the S relay
through the break contact 1 on relay C1 to line
G1 and over line G1 to the closed contact of the
ringing push button 14 which is adapted to be
opened by pressure on the push button, then
through the upper hook switch contacts 17 to
line L1 and over this line conductor to relay I
and through the winding of relay I to positive
battery.

From the description thus far, it will be seen
that I relay is in circuit with relay B and relay S
so that the circuit of either of them may be broken
and relay I will continue to be energized through
the other. At this point it will be well to recall
that relay I will not be energized until relay B has
been energized since break contact No. 1 of relay
B connects L1 to positive battery over break con-
tact No. 2 of relay I.

When the three relays B, I, and S have been
energized as described, this completes a circuit
for operating relay A3 over the following circuit:
From negative battery at relay C5 on its break
contact No. 3, then over each of the break con-

tacts of the five C relays in turn to the inside winding of relay A3, then over conductor 22 to front contact No. 2 of relay B and front contact No. 2 of relay I to positive battery. This prepares the equipment for the selecting operation. The operator at telephone 1 makes the selection by depressing the select button 13 a number of times, the number depending upon which of the other telephones he wishes to select. The first operation in pressing the select button 13 is to establish a short circuit around the transmitter 10 and the receiver 11 over contact 23 and line 24. This shunts the inductive discharge of the relay coils and thus prevents unnecessary noise in the operator's ears. Also, the break contact of the select push button opens the circuit of relay B at contact 21, and this causes the operation of relay A2 and relay C1 over the following circuit: From positive battery and front contact 2 of relay I to back contact No. 2 of relay B, then over line 25 to back contact No. 1 of relay A1 and over line 26 and branch line 27 to the inside winding of relay A2 and then to negative battery, also over line 26 and branch line 28 to inside winding of relay C1 and to negative battery.

Relay A2 locks itself energized over the following circuit: From negative battery on line 30 over branch line 29 to outside winding of relay A2 then through front contact No. 1 of relay A2 and front contact No. 2 of relay A3, and then over line 31 to front contact No. 2 of relay I and positive battery.

Relay C1 locks itself energized over the following path: From positive battery through front contact No. 2 of relay I over line 31 to branch line 32, which is common to the outside windings of all the C relays, through outside winding of relay C1 to front contact 3 of relay C1 and then through break contacts No. 3 of relays C2 to C5 inclusive to negative battery. The spring armatures of the C relays are such that, as C1 is energized, the circuit of relay S is not interrupted since front contact No. 1 of C1 relay makes before the break contact of this relay opens, thus connecting G1 to line 33 before breaking the connection to line 34.

When the select button 13 is restored to normal, relay B again operates, and this results in the operation of relay A1 over the following path: From positive battery, through front contact No. 2 of relay I, to front contact No. 2 of relay B, then over line 22 to front contact No. 2 of relay A2, and then to inside winding of relay A1 and negative battery. The energizing of relay A1 opens the locking circuit for relay A3 by breaking the circuit at contact 3 of relay A1 so relay A3 is released, and this breaks the hold circuit for relay A2 at front contact No. 3 of relay A3.

Relay A1 locks itself energized over the following path: From negative battery to outside winding of relay A1, through front contact No. 2 of relay A1, over line 35 to back contact No. 2 of relay A3, and back contact No. 3 of relay A4 to line 31, and over line 31 to positive battery at front contact No. 2 of relay I.

When the select button is again operated, relay B is released, and this operates relay A4 over the following path: From positive battery through front contact No. 2 of relay I, and back contact No. 2 of relay B, to line 25, through front contact No. 1 of relay A1, to line 36, and branch line 37 to inside winding of relay A4 and negative battery.

Relay A4 locks energized over the following path: From positive battery through front contact No. 2 of relay I, over line 31 to back contact

No. 3 of relay A2, then to front contact No. 1 of relay A4, and outside winding of relay A4 to line 30 and negative battery.

Relay C2 also operates being energized over the following circuit: From positive battery through front contact No. 2 of relay I, back contact No. 2 of relay B, line 25, front contact No. 1 of relay A1, line 36, and branch line 38 to front contact No. 2 of relay C1, to inside winding of relay C2 and negative battery.

Relay C2 is locked energized over a circuit extending from positive battery through front contact No. 2 of relay I, over lines 31 and 32 to outside winding of relay C2, front contact No. 3 of relay C2, and break contacts No. 3 of relays C3 to C5 to negative battery. This operation releases relay C1 since its locking circuit is open at break contact No. 3 of relay C2.

When the select button is restored to normal, relay B again operates.

Relay A3 is energized over a line extending from positive battery through front contact 2 of relay I, front contact 2 of relay B, line 22 to inside winding of relay A3, lines 39 and 40 to front contact 2 of relay A4, and line 30 to negative battery. Relay A1 is released since its locking circuit is opened at back contact 2 of relay A3 and back contact 3 of relay A4.

Upon the next push of the select button 13, relay B is again deenergized, and this causes the operation of A2 over the following circuit: From positive battery and front contact No. 2 of relay I, through back contact 2 of relay B, over line 25, and back contact 1 of relay A1, through lines 26 and 27 and inside winding of relay A2 to negative battery.

Relay A2 locks energized through its outside winding over a circuit extending from negative battery over line 30 and line 29 through outside winding of relay A2, front contact No. 1 of relay A2, front contact No. 2 of relay A3, line 31, front contact 2 of relay I to positive battery.

Relay C1 is momentarily energized over line 26 and branch line 28 to negative battery by the connection of positive battery to line 25, but this does not affect the further operation as C1 cannot lock itself energized at this time owing to the fact that its locking circuit is broken at back contact 3 of relay C2. Relay A4 is released at the contact 3 of A2.

Relay C3 is energized over a circuit which may be traced from positive battery through front contact 2 of relay I, back contact 2 of relay B, line 25, back contact 1 of relay A1, line 26, to contact 2 on relay C2, and inside winding of relay C3 to negative battery.

Relay C3 locks energized over a circuit extending from positive battery over front contact 2 of relay I, lines 31 and 32, outside winding of relay C3, front contact 3 of relay C3, and break contact No. 3 of relay C4 and C5 to negative battery. This breaks the locking circuit of relay C2 at the break contact 3 of C3 to deenergize relay C2.

When the select button is returned to normal, relay B again operates, and relay A1 is energized over the following path: From positive battery through front contact 2 of relay I, front contact 2 of relay B, line 22, front contact 2 of relay A2, and inside winding of relay A1 to negative battery.

The locking circuit of relay A3 is broken at contact 3 of relay A1, so relay A3 releases, thus breaking the locking circuit of relay A2 at front contact 2 of relay A3.

Relay A1 locks energized over a circuit from negative battery over line 30, through the outside winding of relay A1, front contact 2 of relay A1, line 35, to back contact 2 of A3, and back contact 3 of A4, and then over line 31 to front contact 2 of relay I and positive battery.

When select button 13 is again operated, relay B releases and relay A4 operates over the following circuit: From positive battery through front contact 2 of relay I, back contact 2 of relay B, line 25, front contact 1 of relay A1, lines 36 and 37, to inside winding of relay A4 to negative battery. Relay A4 locks energized from positive battery over line 31, through back contact 3 of A2, front contact 1 of A4, outside winding of A4 to negative battery over line 30.

Relay C4 is also energized at this time from positive battery over front contact 2 of relay I, back contact 2 of relay B, line 25, line 36, front contact 2 of relay C3, to inside winding of relay C4, and negative battery. Relay C4 locks energized over a circuit extending from positive battery through front contact 2 of relay I, over lines 31 and 32, to outside winding of C4, front contact 3 of relay C4, and break contact 3 of relay C5 to negative battery. This breaks the energizing circuit for relay C3 at break contact 3 of relay C4 so relay C3 is deenergized.

When the select button 13 is restored to normal, relay B is again energized, and relay A3 is energized over a circuit extending from positive battery through front contact 2 of relay I, front contact 2 of relay B, line 22, inside winding of relay A3, lines 39 and 40, front contact 2 of relay A4, and line 30 to negative battery. Relay A1 is released since its locking circuit is opened at back contact 3 of relay A4, and back contact 2 of relay A3. In this manner relay C4, which is connected to the individual line wire G4, has been selected by four depressions of the select button 13 and is now locked and ready to signal No. 4 telephone. At this time it will be noted that relay C4 is held operated as long as relay I is energized to maintain positive battery on front contact 2 of relay I. Relays A3 and A4 are also held operated so long as relay I maintains positive battery on front contact 2. These, however, are necessary only if continued selections are to be made.

To ring No. 4 telephone, the person making the call at No. 1 telephone pushes the ringing button 14. This opens the operating circuit of relay S which is energized, over a path extending from positive battery through winding of relay I over L1, contact 17, hook switch 12, contacts on ringing key 14, line G1, break contact 1 of relay C1, line 34 to winding of relay S and negative battery. Relay I is still held energized in series with relay B even though relay S is deenergized. Relay S being released supplies one side of ringing current from terminal 19, through back contact 1 of relay S, front contact 1 of relay I, common line L1, to tap T4 and line 41, through one-half mfd. condenser 16 to one side of bell 15 of telephone 4.

The other terminal 20 for supplying ringing current is connected through the 100 ohm winding of A. C. relay R, over back contact 2 of relay S, over line 33, to front contact 1 of relay C4, line G4, to the other side of bell 15 of telephone 4. The bell 15 at telephone 4 will ring as long as ringing button 14 at the calling telephone 1 is held down, because the current which can flow through bell 15 and condenser 16 is insufficient to cause relay R to attract its arma-

ture and energize relay S. If the operator at telephone 1 releases the ringing button 14, the energizing circuit for relay S is again held to cut off the supply of ringing current to bell 15 of telephone 4 at contact 1 of relay S. Thus if more than one telephone is connected on one line, a code may be used to signal either telephone.

When the party at telephone 4 answers, the hook switch 12 of telephone 4 closes, its contacts 17 closing first to shunt the bell 15 of telephone 4 by closing a circuit from line G4 through closed contacts of ringing button 14 and contacts 17 of telephone 4 to terminal T4 on line L1. Relay R is energized over this shunt circuit as follows: from terminal 19 through break contact 1, of relay S, front contact 1 of relay I, line L1 to T4, then through closed contacts 17 of switch 12 and ringing key 14 at telephone No. 4, over line G4 to front contact 1 of relay C4 over line 33, through break contact 2 of relay S, and winding of relay R to terminal 20. This shunt circuit also provides a circuit to energize relay S as follows: From positive battery at relay I, through winding of relay I, line L1 to terminal T4, contacts 17 of telephone 4, contacts of ringing button 14 of telephone 4, line G4, make contact 1 of relay C4, line 33, to contact 2 of relay S. Then when relay R attracts its armature to momentarily energize relay S from positive battery through 50 ohm, resistance 42, contact of relay R, and winding of relay S to negative battery, contact is made at front contact 2 of relay S, and line 33 is thereby connected through this contact to winding of relay S to negative battery.

Both parties are now connected across talking lines L1, L2.

When both parties hang up, contacts 17 and 18 at both telephones are opened, and the holding circuits of relays B, S, and I are broken thus releasing these relays. Release of relay I breaks the holding circuits for all other relays, releasing them and returning the system to rest.

In Fig. 2, I have shown somewhat diagrammatically a bell box 15 to illustrate the use of a biasing spring 43 on the bell arm 44 for preventing tapping of the bells when a call was being made. The purpose of spring 43 is to hold the arm 44 in the position shown during the calling and selecting until the ringing button is operated, and thus avoid the taps of the bells when a call is made.

The condenser 16 in the bell ringing line of each telephone also protects the battery of the system from running down in case of wrong connections of the three lines leading from the telephone to the central station. Since the bell is connected across the lines to be attached to G1 and L1, and battery across L1 and L2, it is evident that, if the line that should be connected to G1 is improperly connected so as to put the battery across the bell terminals, the battery might well be run down before the mistake was located.

It is believed that the manner of connecting and operating the system will be clear from the above description and the advantages thereof readily apparent.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An intercommunication system comprising a plurality of telephones, a ringing bell for each telephone, a selecting switch and a ringing switch at each telephone, a pair of line conductors common to all telephones, and an individual conductor for each telephone, a central station to

which said conductors lead, said station having means operable by successive actuations of any selecting switch to select any other telephone and supply ringing current over the individual conductors of the selecting and selected telephones and talking current over the common conductors.

2. An intercommunication system comprising a plurality of telephones, a ringing bell for each telephone, a selecting switch and a ringing switch at each telephone, a pair of line conductors common to all telephones, and an individual conductor for each telephone, a central station to which said conductors lead, said station having means operable by successive actuations of any selecting switch to select any other telephone and supply ringing current over the individual conductors of the selecting and selected telephones and talking current over the common conductors, each ringing bell having a condenser in series therewith.

3. An intercommunication system comprising a plurality of telephones, a ringing bell for each telephone, a selecting switch and a ringing switch at each telephone, a pair of line conductors common to all telephones, and an individual conductor for each telephone, a central station to which said conductors lead, said station having means operable by successive actuations of any selecting switch to select any other telephone and supply ringing current over the individual conductors of the selecting and selected telephones and talking current over the common conductors, the select switches having means establishing a shunt across their telephones when actuated.

4. An intercommunication system comprising a plurality of telephones, a ringing bell for each telephone, a selecting switch and a ringing switch at each telephone, a pair of line conductors common to all telephones, and an individual conductor for each telephone, a central station to which said conductors lead, said station having means operable by successive actuations of any selecting switch to select any other telephone and supply ringing current over the individual conductors of the selecting and selected telephones and talking current over the common conductors, said central station having means to supply alternating current for ringing purposes only, and means to supply direct current for operating and talking.

5. In a system for selectively interconnecting any pair of a number of telephones for direct talking, a bell for each telephone, a central selecting station, each telephone being connected to the central station by three conductors, two of which are common to all telephones, and are connected through the hook-switch contacts of the telephones to opposite terminals of the series

connected receiver and transmitter of each telephone, and the third of which is individual to each telephone, a selecting switch and a ringing switch at each telephone, control and selecting relays at the station actuated by the selecting switches to select a desired telephone and connect ringing current to its bell under control of the ringing switch at the selecting telephone.

6. In an intercommunicating system comprising a plurality of telephones and a central station, a ringing bell for each telephone, a selecting switch and a ringing switch operable by pushbuttons at each telephone, three talking and signalling channels between one or more telephones and the central station, one of these channels providing means to supply ringing current to the telephones during a ringing period and current for holding certain central station relays during a selecting period.

7. In an intercommunicating system comprising a plurality of telephones and a central station, a ringing bell for each telephone, a selecting switch and a ringing switch operable by pushbuttons at each telephone, selecting means at the central station controlled by said selecting switch, three talking and signalling channels between one or more telephones and the central station, one of said channels providing means to supply selecting current and ringing current under control of said push buttons.

8. An intercommunication system comprising a plurality of telephones, a ringing bell for each telephone, a selecting switch and a ringing switch at each telephone, a pair of line conductors common to said telephones, and an individual conductor for each telephone, a central station to which said conductors lead, said station having means operable from any selecting switch to select any other telephone and supply ringing current over the individual conductors of the selecting and selected telephones and talking current over the common conductors.

9. An intercommunication system comprising a plurality of telephones, a ringing bell for each telephone, a selecting switch and a ringing switch at each telephone, a pair of line conductors common to said telephones, and an individual conductor for each telephone, a central station to which said conductors lead, said station having means operable from any selecting switch to select any other telephone and supply ringing current over the individual conductors of the selecting and selected telephones and talking current over the common conductors, said ringing bells each having biasing means to prevent the bells tapping until the ringing switch is operated.

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