

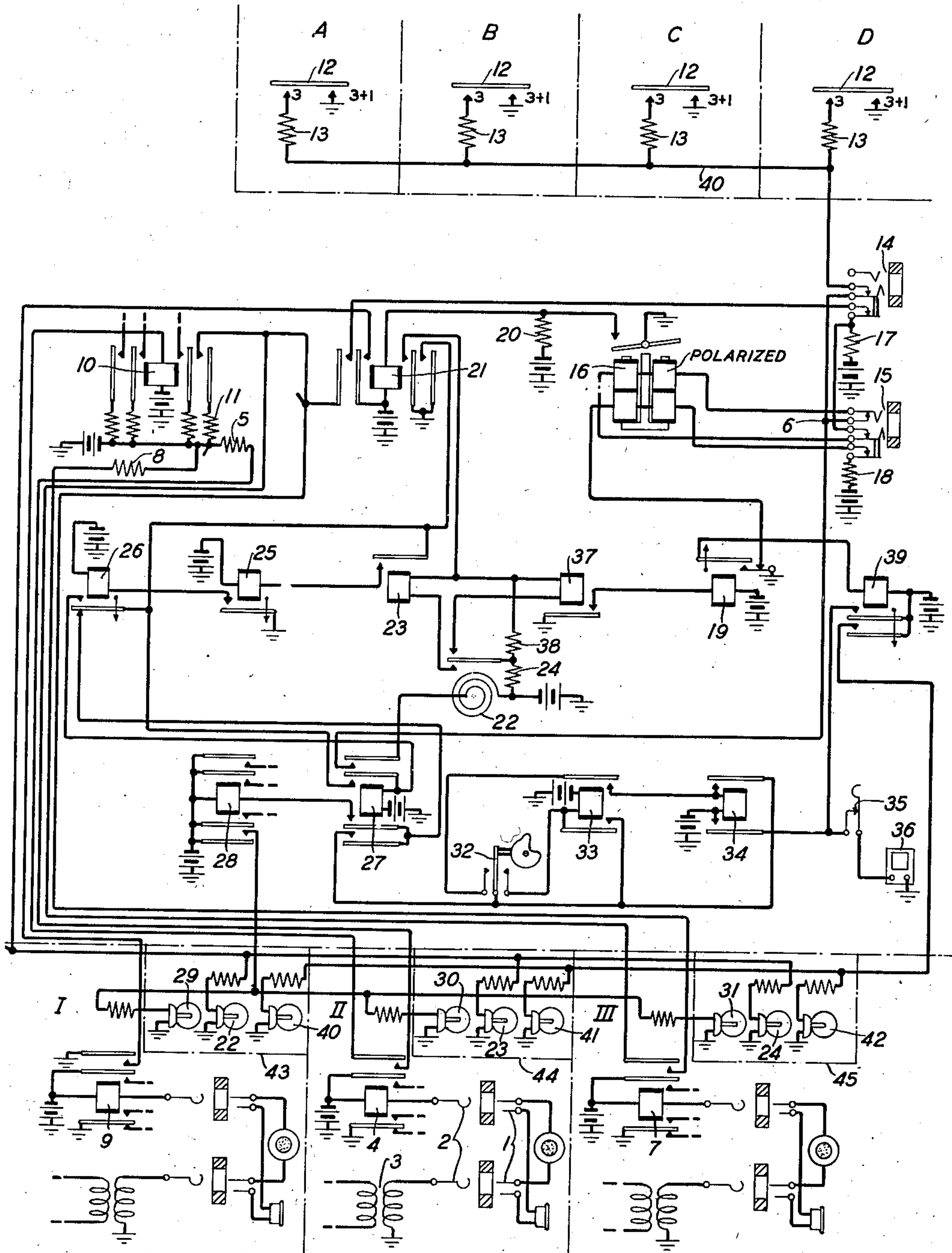
Nov. 10, 1936.

C. G. MILLER

2,060,585

TELEPHONE SIGNAL CIRCUIT

Filed Sept. 6, 1935



INVENTOR
C. G. MILLER
BY *GEYolk*
ATTORNEY

UNITED STATES PATENT OFFICE

2,060,585

TELEPHONE SIGNAL CIRCUIT

Charles Gideon Miller, Montclair, N. J., assignor
to American Telephone and Telegraph Com-
pany, a corporation of New York

Application September 6, 1935, Serial No. 39,469

7 Claims. (Cl. 179—27)

This invention relates to telephone systems and has for its object to give improved indication of the functioning of such systems.

In telephone offices employing call distribu-
tion, it is customary to direct only one call to an
operator at a time, other calls being held in abey-
ance until an operator is idle. Heretofore, it has
been customary to employ a calls waiting signal
arrangement indicating that certain fixed num-
bers of calls are waiting. This signal has the
drawback that a given number of waiting calls
may be negligible when a large force of operators
is on duty and mean a serious delay with a small
force.

In accordance with the present invention, a
calls waiting signal is provided which varies in
sensitivity in accordance with the number of op-
erators working.

More specifically, the signal operating means is
connected to a point, the potential of which is
varied according to the number of operators' po-
sitions in service and the number of calls stored.
To this end, each position as it is occupied con-
nects battery through a resistance to this point
while as each call is stored, the link connects
ground through a resistance to the same point.
The signal will be arranged to operate at such a
potential as to give the desired indication.

The invention will be more clearly understood
from a consideration of the following description
in connection with the attached drawing which
shows the calls waiting signal circuit together
with parts of several link circuits and parts of
several operators' positions.

This calls waiting signal is adapted for use in
connection with such operator's equipment as
shown in the patent of J. F. Dahl, 2,020,458,
granted Nov. 12, 1935, to which reference is made
for complete operation of the position and link
circuits. In the system of this application, when
a call reaches the office at which the operator's
equipment is located, an idle link circuit is seized
and this link hunts for the line over which the
call is received. At the same time the link starts
hunting for an idle operator's position. When the
incoming line is found, the link sequence switch
advances to position 3 and remains in this posi-
tion until the operator's position has been found.
While the link sequence switch remains in posi-
tion 3 the call is waiting for attention and the
link sequence switch connects ground through a
resistance to the calls waiting signal circuit.

When the sequence switch of one of the link
circuits, indicated in the drawing at A, B, C, and

D, for example link A, arrives in position 3, it con-
nects ground over cam 12 through resistance 13 to
conductor 40 leading to the calls waiting signal
circuit, where it extends over the ring contact of
jack 14 to point 6 and thence over the tip con-
tact of jack 15, upper windings of polarized relay
16, ring contact of jack 15 to battery through re-
sistance 17. Normally relay 16 is polarized by a
circuit from battery through resistance 18, aux-
iliary contact of jack 15, lower windings of relay
16 to ground at the normal contact of relay 19.
As thus biased, relay 16 does not close its contact
until two link circuits connect ground to its upper
windings. When this occurs, ground is connected
in shunt of battery through resistance 20 to the
winding of relay 21, operating that relay. Relay
21 lights green lamps 22, 23 and 24 in the calls
waiting signals 43, 44 and 45 respectively at the
operator's positions to indicate that calls are wait-
ing.

At the operator's desk, the positions are oc-
cupied when the operator inserts her headset plug
into the position jack. When an operator inserts
her plug 1 into the jack 2 of position II a circuit is
completed from ground through the right wind-
ing of repeating coil 3, tips of jack 2 and plug 1
including the operator's transmitter, winding of
relay 4 and battery. Relay 4 marks the position
as occupied and ready to receive calls. It also
closes a circuit over its outer upper front contact
from battery through resistance 5, to the outer
left armature of relay 21 in the calls waiting
signal circuit. In a similar manner, relay 7 of
position III connects battery through resistance 8
to the armature of relay 21. Position I is shown
as one served by more than one calls waiting sig-
nal circuit as might be desirable in large offices.
Therefore relay 9, connects ground over its outer
upper contact to the winding of relay 10 which
connects battery through resistance 11 to the
armature of relay 21 and connects battery
through similar resistances to relay 21 of other
calls waiting signal circuits.

Until at least two calls are waiting, these posi-
tion batteries are ineffective. However, when
relay 21 operates, it connects these batteries over
its outer left contact, auxiliary contact of jack
14 in parallel with battery through resistance 17
and over the ring contact of jack 15, the upper
windings of relay 16 and the tip contact of jack
15 to point 6, to which point the voltmeter relay
22, which controls the other signal lamps, is
connected as will appear immediately.

Voltmeter relay 22 normally holds its lower
contact closed. Therefore when relay 21 oper-

ates a circuit is closed from ground at the inner right contact of relay 21, winding of relay 23, lower contact of relay 22, resistance 24 and battery. Relay 23 operates, closing a circuit from
 5 ground at the outer right contact of relay 21, front contact of relay 23, winding of relay 25 and battery. Relay 25 causes the operation of relay 26 and relay 27 in turn, relay 27 locking under the control of relay 21. Relay 27 connects
 10 the winding of voltmeter relay 22 to point 6, in parallel with the position resistances.

Voltmeter relay 22 is adjusted to open its lower contact at one predetermined potential and to close its upper contact at a second higher po-
 15 tential.

Since the positive pole of battery is connected to ground, as additional positions are put into service, the potential of point 6 decreases, while as additional link circuits come into waiting po-
 20 sition the potential of point 6 is raised. With a fixed number of positions in service, the opening of the lower contact of relay 22 and the closure of its upper contact indicate that certain definite numbers of calls are waiting. However, where
 25 the number of positions varies, the number of calls waiting indicated by these conditions also varies, but the proportional indication remains about the same.

When the potential of point 6 becomes high
 30 enough to cause relay 22 to open its lower contact relay 23 releases in turn releasing relays 25 and 26, which are slow to release. If the condition persists until relay 26 closes its back contact, a circuit is closed from ground at the outer
 35 right contact of relay 21, back contact of relay 26, inner lower front contact of relay 27 to the winding of relay 28 and battery. Relay 28 lights white lamps 29, 30, 31, etc. in this calls waiting signals at the positions, indicating that there are
 40 a considerable number of calls waiting. A circuit is also closed in parallel with relay 28 over the outer lower contact of relay 27 to interrupter 32. Interrupter 32 operates relays 33 and 34, followed by buzzer 36 if the condition continues
 45 a half minute or more. The buzzer can be silenced by operating key 35.

If the number of waiting calls drops, reducing the voltage of point 6, relay 22 will reclose its lower contact, reoperating relays 23, 25, 26 and 27
 50 releasing relay 28 and extinguishing the white lamps.

If the number of calls waiting increases until the potential of point 6 is sufficient to cause relay 22 to close its upper contact, relay 37 oper-
 55 ates, in turn operating relay 19 which opens the polarizing circuit for relay 16 and closes a circuit for relay 39. Relay 39 lights red lamps 40, 41 and 42 and also operates buzzer 36. The lamps are immediately extinguished when relay
 60 22 opens its upper contact and releases relays 19 and 39.

The resistances selected for the circuit forming the basis of the present disclosure are 426 ohms for resistance 17, 1260 ohms for resistances 5 and
 65 8, and 4800 for resistance 13. Resistance 11 depends on the number of signal circuits to which the position is common, being a corresponding multiple of the single position resistance. These resistances and the adjustment of the voltmeter
 70 relay are made such as to give the white lamp signal whenever the number of calls waiting may delay the time of answer over two seconds and give the red lamp signal when the number of

calls waiting exceeds the number required for the white lamp signal by approximately eighty per cent. The actual number of waiting calls necessary to give either signal will vary with the number of positions occupied.

What is claimed is:

1. In a telephone system, a plurality of operators' positions, a plurality of link circuits having access to said positions, means to seize said link circuits, a calls waiting signal controlled by said
 10 link circuits when seized, and means to vary the sensitivity of said signal in accordance with the number of said operators' positions.

2. In a telephone system, a plurality of operators' positions, a plurality of link circuits hav-
 15 ing access to said positions, means to seize said link circuits, a calls waiting signal controlled by said link circuits when seized, means to vary the sensitivity of said signal in accordance with the number of said operators' positions, and
 20 means to indicate the operation of said signal at each of said operators' positions.

3. In a telephone system, a plurality of operators' positions, a plurality of link circuits having access to said positions, means to seize said link
 25 circuits, a calls waiting signal at each operator's position, and means to operate said signal to indicate when the relation between the number of calls waiting and the number of operators' positions in service reaches a predetermined ratio.

4. In a telephone system, a plurality of operators' positions, a plurality of link circuits having access to said positions, means to seize said link
 30 circuits, a calls waiting signal at each operator's position, and means to variably operate said signal to indicate when the relation between the number of calls waiting and the operators' positions in service reaches a plurality of predetermined ratios.

5. In a telephone system, a plurality of operators' positions, a plurality of link circuits having access to said positions, means to seize said link
 35 circuits, a calls waiting signal responsive to a given potential, means to reduce the potential connected to said signal as each of said positions is occupied, and means to increase the potential connected to said signal as each of said link
 40 circuits is seized.

6. In a telephone system, a plurality of operators' positions, a plurality of link circuits hav-
 45 ing access to said positions, means to seize said link circuits, a calls waiting signal variably responsive to a plurality of given potentials, means to reduce the potential connected to said signal as each of said positions is occupied, means to
 50 increase the potential connected to said signal as each of said link circuits is seized, and means to indicate at each of said operators' positions the response of said calls waiting signal to each
 55 of said potentials.

7. In a telephone system, a plurality of operators' positions, a plurality of link circuits having access to said positions, means to seize said link
 60 circuits, a calls waiting signal circuit, means connected to a point in said circuit to display a signal at a given potential on said point, means to connect battery through parallel resistances to said point as each of said positions is occupied,
 65 and means to connect ground through parallel resistances to said point as each of said link circuits is seized.

CHARLES GIDEON MILLER.