

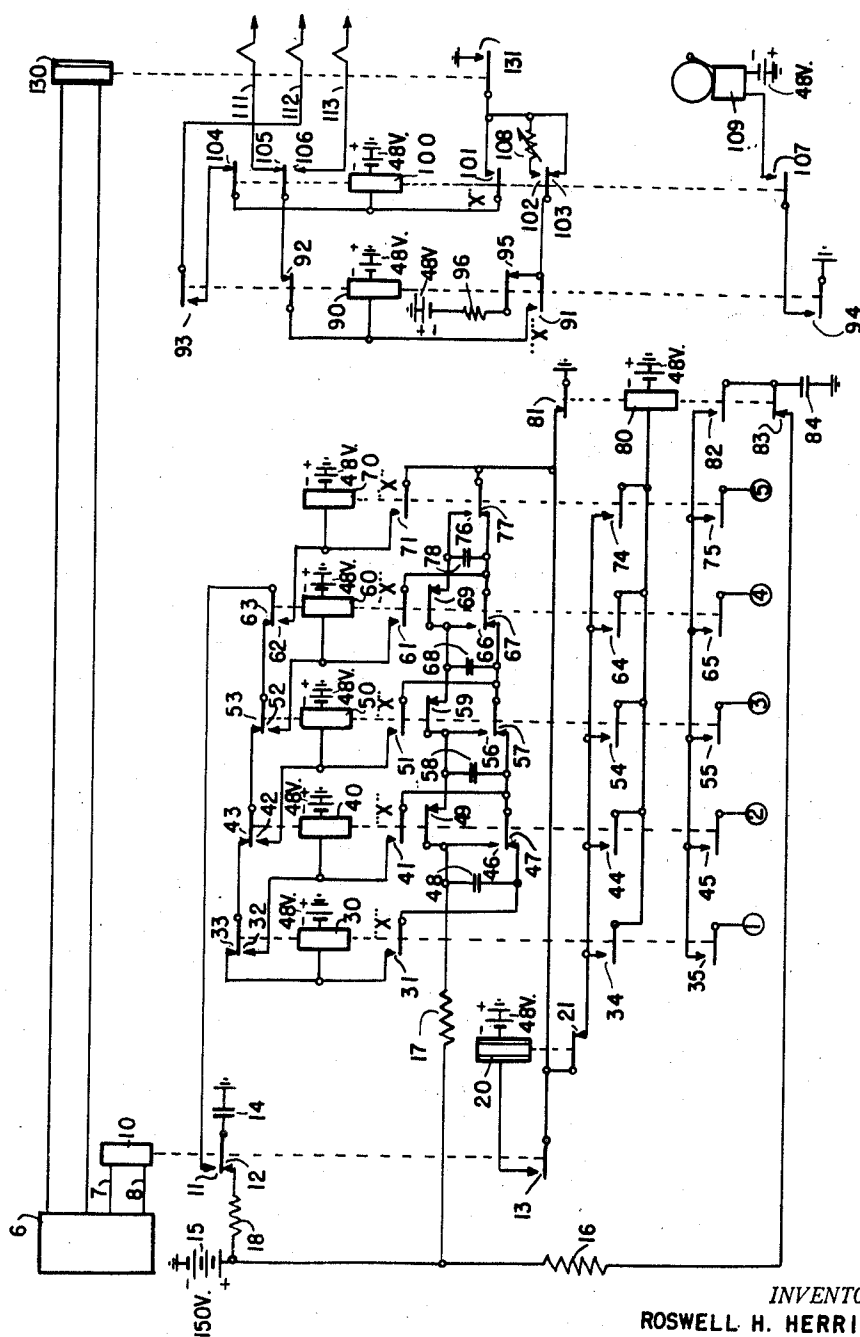
July 28, 1953

R. H. HERRICK

2,647,250

ALL-RELAY SELECTIVE CALLING SYSTEM

Original Filed Nov. 25, 1949



INVENTOR.
ROSWELL H. HERRICK

BY *Wm. Peter Cusw.*

ATTY.

UNITED STATES PATENT OFFICE

2,647,250

ALL-RELAY SELECTIVE CALLING SYSTEM

Roswell H. Herrick, Lorain, Ohio, assignor to Automatic Electric Laboratories, Inc., Chicago, Ill., a corporation of Delaware

Original application November 25, 1949, Serial No. 129,488, now Patent No. 2,600,648, dated June 17, 1952. Divided and this application November 30, 1951, Serial No. 259,117

6 Claims. (Cl. 340-168)

1

This invention relates to an all-relay selective calling system of the type wherein one out of a large number of receivers in communication with a single transmitter may be alerted for conversation.

It is an object of this invention to provide an all-relay selective calling system in which a particular series of digital pulses is individual to the operation of each receiving station.

The registering circuit used in conjunction with the invention wherein two registering relays and a temperature-sensitive resistor provide a response to a three digit system is disclosed in the application of Roswell H. Herrick, Serial No. 129,488, now Patent No. 2,600,648, issued June 17, 1952, of which this application is a division.

Another object of the invention is to provide a selective calling system including a series of counting relays arranged to be energized sequentially in which a series of condensers is arranged to speed the release of each counting relay when its locking circuit is broken.

Other objects of the invention will be apparent from the following specification taken in connection with the accompanying drawing.

Referring generally to the drawing a receiver 6 picks up pulse signals from a transmitter (not shown). These pulses are utilized to energize a pulse relay 10. Operation of the relay 10 energizes a slow-release relay 20 and also a series of five counting relays 30, 40, 50, 60 and 70 in sequence. The operation of each counting relay breaks a locking circuit for the preceding counting relay so that only one counting relay will be operated at a time. Each counting relay has contacts which control one of a series of terminals 1 to 5. The terminals 1 to 5 are accessible for attachment of three registering relay leads 111, 112 and 113. These leads are connected to terminals 1 to 5 in accordance with the call number assigned to the particular unit in question, lead 111 being connected to the terminal representing the first digit, lead 112 the second digit, and lead 113 the third digit.

The release of slow-release relay 20 at the conclusion of the pulse or pulses constituting a particular digit actuates a relay 80 which closes its contacts 82 to complete a condenser discharge circuit through one of the terminals 1 to 5 and lead 111 provided lead 111 is connected to a terminal which has contacts closed in response to the called digit. If the discharge path is the proper one the condenser discharge energizes a registering relay 90, which locks up and prepares a circuit through lead 112 to a registering relay

2

100 which is operated in response to a particular second digit pulse series.

Relay 100, upon being energized, has contacts which complete a locking circuit for itself and break the locking circuit of relay 90. If a third series of digit pulses then completes a circuit through lead 113 relay 90 is reoperated. It is the joint operation of relays 90 and 100 which completes a circuit to an alarm signal 109. A more detailed explanation of the operation of the various circuits in the unit illustrated will be given hereinafter.

While only a single unit is shown on the drawing a receiving system is composed of a number of such units wherein the receivers are in communication with the same transmitter. All of the units are identical in construction, the only difference being that leads 111, 112 and 113 are connected to different numbers and sequences of terminals 1 to 5 in order that only one unit may be signaled by a particular series of digital pulses.

The receiver 6 may be of the conventional type of radio receiver. A pair of leads 7 and 8 communicate digit pulses picked up by receiver 6 to the relay 10. The first pulse on relay 10 closes contacts 13 to complete the following circuit for the operation of relay 20: ground, contacts 81, contacts 13, relay 20, and battery to ground. Relay 20 then remains operated due to its slow to release characteristics for the series of impulses making up a single digit but releases during the pause between digits.

Reception of the carrier on receiver 6 completes a circuit for the operation of a squelch relay 130. Relay 130 closes its contacts 131 to furnish locking ground for the subsequent operation of relays 90 and 100 in a manner to be explained hereinafter.

Before receipt of a pulse a condenser 14 was charged through contacts 12 by the following circuit: ground, condenser 14, contacts 12, resistor 18, direct current source 15, and ground. Resistor 18 is present in the circuit for protective purposes and may conveniently have a resistance of about 1,000 ohms. The direct current source 15 may conveniently have a potential of about 150 volts.

On each pulse of relay 10 the contacts 12 are opened and the contacts 11 closed to create a condenser discharge path for the operation in sequence on successive pulses of the counting relays 30, 40, 50, 60 and 70. The discharge of condenser 14 on the first pulse operates relay 30 over the following circuit: ground, condenser 14, contacts 11, contacts 63, contacts 53, contacts 43, contacts 33, relay 30, and battery to ground.

3

Upon receipt of the pulse from condenser 14, relay 30 locks up through its "X" contacts 31 by the following circuit: ground, battery, relay 30, contacts 31, contacts 47, contacts 57, contacts 67, contacts 77, contacts 81, and ground.

Upon operation, relay 30 opens its contacts 33 and closes its contacts 32 to prepare a circuit for the operation of relay 40. Relay 30 also closes its contacts 34 to prepare a circuit for the operation of relay 30 which will be completed upon the release of relay 20. Contacts 35 of relay 30 are closed to prepare a condenser discharge circuit through terminal 1. If no further pulses are received relay 30 remains operated until its locking circuit is interrupted by operation of relay 80. In this event the digit 1 would be recorded on relay 90 at stations which had call numbers beginning with the digit 1.

A second pulse following before the release of relay 20 passes through contacts 32 to operate relay 40. This relay then closes its "X" contacts 41 to complete a locking circuit for itself through contacts 57, 67, 77, 81 and ground. Relay 40 then opens its contacts 47 to break the locking circuit of relay 30 and closes its contacts 46 to enable the discharge of a condenser 48 to speed the release of relay 30.

Condensers 48, 58, 68 and 78 all serve the purpose of speeding the release of one of the counting relays. The operation will be explained with reference to condenser 48. This condenser is initially charged through the following circuit: ground, direct current source 15, resistor 17, condenser 48, contacts 47, 57, 67, 77 and 81 and ground. Resistor 17 is placed in the circuit for protective purposes and many conveniently be of about 10,000 ohms resistance.

When contacts 47 are opened the charging path for condenser 48 is broken and when contacts 46 are closed the condenser plate with the positive charge is grounded and the plate with the negative charge is connected through relay 30 in opposition to the battery current which has a positive ground. The relay battery potential is about 48 volts while the condenser 48 potential is about 150 volts. This high condenser potential in opposition to the battery current quickly releases relay 30.

When relay 40 is operated its contacts 43 are opened and its contacts 42 closed to prepare a circuit for the operation of relay 50. Its contacts 44 and 45 are closed to prepare circuits for the operation of relay 80 and through terminal 2 respectively. Thus if there are only two pulses relay 40 alone of the counting relays will be energized and a circuit through terminal 2 will be prepared in all stations and completed through relay 40 in stations which have the digit 2 as the first digit in their call numbers.

If a third pulse is delivered through relay 10 before relay 20 releases, relay 50 will be energized by the discharge of condenser 14 through contacts 42 and its various contacts will be operated in a manner exactly analogous to that outlined above for relay 40. Similarly a fourth pulse will energize relay 60 through relay 50 contacts 52 and a fifth pulse will energize relay 70 through relay 60 contacts 62. The embodiment illustrated shows five counting relays which allows for a calling system utilizing digits 1 to 5. More counting relays may be added if an expanded digit system is desired.

The registering circuit consists of relays 90 and 100 with their accessory circuits. The first incoming signal passes through lead 111, the sec-

4

ond through lead 112 and the third through lead 113. These leads are connected to terminals 1 to 5 in accordance with the number assigned to the unit. For example, for number 531 lead 111 would be connected to terminal 5, lead 112 to terminal 3, and lead 113 to terminal 1. For number 222, all three leads would be connected to terminal 2.

The registering relays 90 and 100 are initially energized by a condenser discharge circuit responsive to operation of relay 80. When relay 80 is released a registering relay condenser 84 is charged from direct current source 15 through protective resistor 16 and contacts 83.

With conclusion of a pulse or pulses constituting a single digit an operating circuit is prepared for relay 80 through one of contacts 34, 44, 54, 64 or 74. Upon the conclusion of the series of pulses relay 20 releases to complete the circuit for relay 80 through contacts 21.

At its contacts 81 relay 80 breaks the locking circuit for whichever counting relay is operated. At its contacts 83 relay 80 opens the charging circuit of condenser 84 and at its contacts 82 closes a discharge circuit for condenser 84 through whichever of terminals 1 to 5 has its associated counting relay operated.

If, for example, the number of the unit is 534 and this is the unit being called the first series of pulses will leave counting relay 70 operated and contacts 75 will be closed. Relay 90 will then be energized through the following circuit: ground, condenser 84, contacts 82, contacts 75, terminal 5, lead 111, contacts 105, contacts 92, relay 90, and battery to ground.

Relay 90 locks up over its "X" contacts 91 by the following circuit: ground, battery, relay 90, contacts 91, contacts 103, contacts 131 and ground.

At its contacts 93 relay 90 prepares a circuit for the operation of relay 100 by a condenser discharge through conductor 112.

Conductor 112 is connected to terminal 3. When relay 20 releases at the conclusion of the pulses representing digit 3, relay 80 operates and condenser 84 discharges through contacts 82 and 55, terminal 3, conductor 112, contacts 93, contacts 104, relay 100, and battery to ground.

Relay 100 then locks up over its "X" contacts 101 through contacts 131 to ground. At the same time the contacts 103 are opened to break the direct locking circuit of relay 90 and the contacts 102 are closed to complete the following circuit for a temperature-sensitive resistor 108; ground, contacts 131, resistor 108, contacts 102, contacts 95, resistor 96, and battery to ground. Resistor 96, which is in the circuit for protective purposes, may conveniently have a resistance of about 1,000 ohms.

The temperature-sensitive resistor 108 is of the type which offers high resistance when it is cold but very little resistance when it is heated. Consequently, although it is momentarily in the locking ground circuit of relay 90 when its circuit is first prepared it offers such high resistance on account of its cold state that the locking circuit of relay 90 breaks at the "X" contacts 91. The contacts 95 then close and resistor 108 heats up to a point where it offers little resistance to the flow of current.

When the third digit (4 in the assumed example) is counted on relay 60 relay 100 contacts 106 are closed and the following circuit is thereby provided for the reoperation of registering relay 90: ground, condenser 84, contacts 82 and 65,

5

terminal 4, conductor 113, contacts 106 and 92, relay 90, and battery to ground.

Relay 90 is now locked up over the following circuit through resistor 108 which is hot and therefore offers little resistance: ground, battery, relay 90, contacts 91, contacts 102, resistor 108, contacts 131, and ground.

Relays 90 and 100 are now both operated and their contacts 94 and 107 are closed to complete a circuit for the operation of alerting signal 109.

The three-digit five-numbered system illustrated will allow for 125 calling stations. If there are this many stations the first digit will operate relay 90 in 25 of the stations, the second will operate relay 100 in five of the 25, and the third will reoperate relay 90 in one of the five to give an alerting signal only at the station called. The stations which had relay 90 or 100 operated but did not complete the call will remain partially operated until the carrier ceases at which time relay 130 will release and open its contacts 131. This will break the locking circuits for whichever of relays 90 and 100 are operated. The operation of relay 80 had previously opened its contacts 81 to release any of the counting relays which may have been locked.

While the preceding description has reference to a single embodiment of the invention this should not be construed to limit the scope of the invention other than as necessitated by the appended claims.

What is claimed is:

1. In a counting relay circuit, a plurality of counting relays operable in sequence by digital pulses, a locking circuit for each of said relays, all except the last of said locking circuits passing through contacts of the succeeding relay which open when said succeeding relay is energized, a condenser associated with each locking circuit, means for charging said condensers, and contacts on each relay except the first for discharging said condenser through the locking circuit of the preceding relay, the condenser discharge being opposed to the battery current holding the said preceding relay in the operated condition whereby the said preceding relay is very quickly deenergized.

2. A quick-release circuit for a relay comprising a relay having a winding, a holding circuit for said relay including said winding, means for closing said holding circuit to thereby establish a current flow therein in one direction, a condenser, means for charging said condenser, and means for including said condenser in said holding circuit with the winding of said relay, said condenser discharge establishing a current flow in said circuit in a direction opposed to that of the original holding current in the circuit to thereby accelerate the release of said relay.

3. In a selective signalling unit, means for receiving a plurality of pulses, a pulse relay, means for operating said pulse relay responsive to said pulses, a plurality of counting relays, means operated responsive to the operation of said pulse relay for sequentially operating said counting relays, each counting relay having a locking circuit, each locking circuit except the last including contacts of the next succeeding counting relay, said contacts opened by the operation of the next succeeding counting relay, a plurality of condensers, a charging circuit for said condensers, each condenser having a discharge circuit, each discharge circuit except the last in-

6

cluding contacts of the next succeeding counting relay, said last contacts closed by the operation of the next succeeding counting relay, each of said discharge circuits including the winding of one of said counting relays preceding the counting relay having the said closing contacts of said discharge circuit, whereby the operation of said relay which break the locking circuit to the preceding relay completes the discharge circuit to speed the release of the preceding relay to cause a rapid sequential operation of said counting relays.

4. In a selective signalling unit, means for receiving a plurality of groups of pulses, a pulse relay, means for operating said pulse relay responsive to said pulses, a slow release relay, an operating circuit for said slow release relay controlled by said pulsing relay, whereby said slow release relay restores between groups of pulses, a plurality of counting relays, means operated responsive to the operation of said pulse relay for sequentially operating said counting relays, means operated responsive to the particular counting relay operated at the end of each group of pulses and the restoration of said slow release relay at the end of each group of pulses for indicating the operated counting relay, each counting relay having a locking circuit, each locking circuit except the last including contacts of the next succeeding counting relay, said contacts broken by the operation of the next succeeding counting relay, a plurality of condensers, a charging circuit for said condensers, each condenser having a discharge circuit, each discharge circuit except the last including contacts of the next succeeding counting relay, said contacts closed by the operation of the next succeeding counting relay, each of said discharge circuits including the winding of one of said counting relays preceding the counting relay having the contacts included in said discharge circuit, whereby the operation of said relay which breaks the locking circuit to the preceding relay completes the discharge circuit to speed the release of the preceding relay to cause a rapid sequential operation of said counting relays.

5. In a selective signalling unit as claimed in claim 4, said fourth means comprising a series of terminals, one of said terminals for each of said counting relays, circuits connected to each terminal, a condenser, said condenser discharged through the circuit of the terminal corresponding to the counting relay operated at the end of each group of pulses.

6. A quick-release circuit for a relay comprising a first relay having a winding, a holding circuit for said first relay including said winding, means for closing said circuit to thereby establish a current flow therein in one direction, a condenser, means for charging said condenser, a second relay, means operated by said second relay to sequentially break said holding circuit and remake said holding circuit by interposing said condenser in said holding circuit, said condenser discharging through said winding of said first relay in said circuit, said condenser discharge establishing a current flow in said circuit in a direction opposed to that of the original holding current in the circuit to thereby accelerate the release of said relay.

ROSWELL H. HERRICK.

No references cited.