

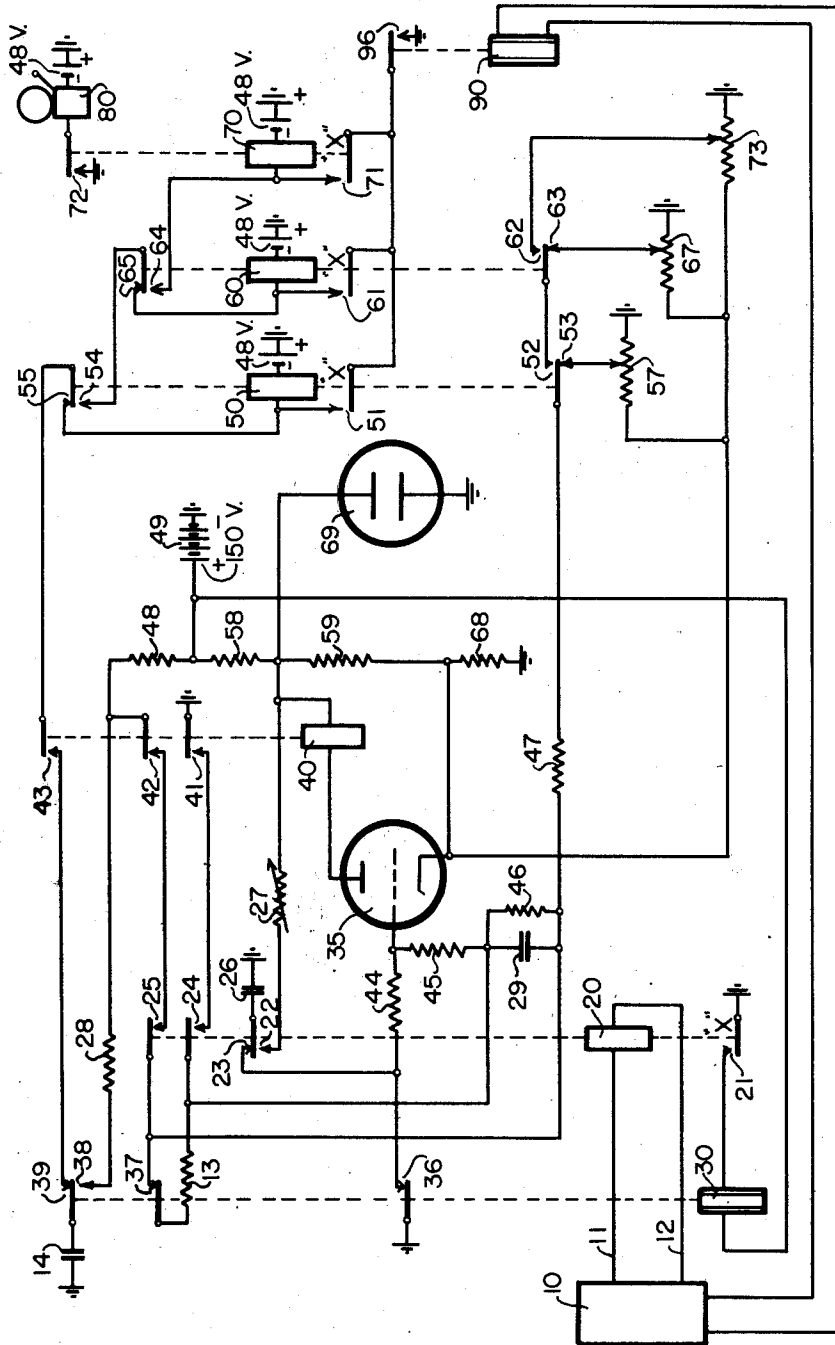
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SELECTIVE SIGNALING SYSTEM EMPLOYING CONDENSER CHARGE

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SELECTIVE SIGNALING SYSTEM EMPLOY-
ING CONDENSER CHARGE

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This invention relates to selective signaling systems and more particularly to a selective calling system in which one of a large number of receivers in communication with a single transmitter may be alerted.

In the present invention a series of recording relays may be set to respond to a series of digital pulses which may all be of the same tone frequency.

It is an object of the invention to provide a signaling system in which an audible or visual signal may be arranged to operate in response to a particular series of digits each comprising a predetermined number of pulses.

Another object of the invention is to provide a signaling system in which a counting relay is operated by an electron tube the firing of which is controlled by a condenser charge, the charge on the condenser being proportional to the number of pulses in a digit received by the receiver system.

A further object of the invention is to provide a signaling system in which a counting relay will be operated upon the reception of more than the required number of pulses for a given digit but will be prevented from recording in the event this occurs.

A feature of the invention is the use of two condensers to fire an electron tube, one condenser being charged during receipt of each pulse and then transferring its charge to a second condenser after receipt of each pulse; the second condenser being connected to a grid to control the firing of an electron tube.

A further feature of the invention is the provision of variable resistors which may be switched into an electron tube circuit to control the level at which a condenser charge will overcome the grid bias and fire the tube.

Other objects and features will become apparent from a perusal of the drawing in connection with the following detailed explanation.

The drawing illustrates a single embodiment of the invention. A radio receiver 10 indicated in block form receives pulses from a transmitter (not shown). These pulses energize a pulsing relay 20 which has contacts to complete the circuit of a slow-release relay 30 and a condenser discharge path for the operation of an electron tube 35.

Firing of the tube 35 energizes a counting relay 40, contacts of which complete a circuit to energize a recording relay 50. Two other recording relays, 60 and 70, are arranged to be energized in sequence when relay 40 is operated during subsequent digit pulses.

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Upon the operation of relay 70 a circuit is completed for the operation of an alarm bell 80.

While only a single unit is shown a mobile radio telephone system would actually consist of a number of radio receivers tuned to receive impulses from a single transmitter. All of the impulse translating signal devices associated with the receivers would be identical to the one embodied in the drawing. Each, however, would be set to respond to a different sequence of digits in a manner to be more fully described hereinafter.

When an impulse is received in receiver 10 it is transmitted as an electric current to relay 20 over a circuit including conductors 11 and 12. Relay 20 is energized by the pulses. On the initial pulse squelch relay 90 is energized to close its contacts 96. On this pulse relay 20 closes its "X" contacts 21 to furnish ground for the operation of slow-to-release relay 30 by the following circuit: ground, contacts 21, relay 30, battery 49, and ground. Relay 30 remains operated during any series of impulses constituting a digit but releases between digits. Relay 30, upon operating, at contacts 38 completes a circuit through resistances 28 and 48 for charging condenser 14, at contacts 37 opens the discharge circuit for condenser 29, and at contacts 36 opens the discharge circuit for condenser 26. Relay 90 and contacts 96 prepare the locking circuits for recording relays 50, 60 and 70.

When relay 20 operates it closes its contacts 22 to complete the following charging circuit for a condenser 26: ground, battery 49, resistor 58, variable resistor 27, contacts 22, condenser 26, and ground.

Upon the release of relay 20 at the conclusion of the pulse the condenser 26 discharges its charge into a condenser 29 by the following circuit: ground, condenser 26, contacts 23, resistor 44, resistor 45, condenser 29, resistor 47, potentiometer 57, and ground (potentiometer 67 or potentiometer 73 may be substituted for potentiometer 57, depending on the condition of the circuit).

Condenser 26 is charged at constant supply voltage determined by regulator tube 69 through resistor 58 and variable resistor 27. Since the pulsing period of relay 20 is of short duration the resistors in the charging circuit of condenser 26 limit the charge so that the voltage of the charge on condenser 26 is less than the charging voltage. This is desirable for a reason which will more fully appear hereinafter, and the variable resistor 27 is adjusted to limit the initial charge on condenser 26 to a rather low voltage.

The release of relay 20 at the conclusion of the first pulse closes a circuit in which condensers 26 and 29 are in series. Consequently, there is an equilibrium of charge set up between the two condensers, condenser 26 retaining a residual charge. The second pulse then places an additional charge on condenser 26 so that it is charged to a higher level at the conclusion of the second pulse than the first. The equilibrium between condensers 26 and 29 after the second pulse is therefore at a higher level than after the first and the residual charge on condenser 26 is likewise at a higher level. The third pulse then results in a still higher charge level on condenser 26 and the subsequent equilibrium between condensers is at a higher level than the previous equilibrium. Succeeding pulses repeat the cycle but each succeeding charge into condenser 29 tends to level off so that the increment becomes smaller each time.

It may be seen that a series of equilibriums at successively higher levels could be built up on condensers 26 and 29 if condenser 26 were always charged to the same level. However, the succeeding increments would decrease much more quickly in this event and the bias overcoming effect would be harder to control as the number of pulses increased. By the proper setting of resistor 27 the gaps between successive equilibriums are more distinct.

Since the tube 35 is normally set to conduct at a level below the charge on condenser 26 there is some possibility that during the transfer of charge from condenser 26 to condenser 29 between pulses, tube 35 will conduct for an instant. However, such conducting period is of too short duration to operate relay 40. Tube 35 will not conduct for an interval sufficiently long to operate relay 40 until the proper charge is built up on condenser 29.

A resistor 68 provides an essentially constant negative bias for the grid of the tube 35. This bias is counterbalanced by the voltages across the condenser 29 and one of the potentiometers 57, 67 and 73.

As previously explained the total charge on condenser 29 is almost proportional to the number of pulses in the dialed digit. Since the voltage accumulated across condenser 29 is positive with respect to the grid of the tube 35 it opposes and overcomes the bias of tube 35 at a level which may be set by adjustment of the potentiometers 57, 67, and 73 for any desired digits. When each potentiometer is set for a particular digit the anode current of tube 35 will rise to the operating value of counting relay 40 on the desired number of pulses. The RC time constant of the condenser 29-resistor 46 combination is such as to allow the tube 35 to conduct for several seconds. However, as explained below, the condenser charge is dissipated as soon as relay 40 is operated and tube 35 then ceases to conduct.

In the circuit shown in the drawing a regulator tube 69 is incorporated. This may be a gas tube such as a neon tube which will maintain the voltage through resistor 27 to condenser 26 at a constant value.

When relay 40 is energized by plate current from the tube 35 it closes its contacts 43 to prepare the following condenser discharge circuit for the operation of recording relay 50: ground, condenser 14, contacts 39, contacts 43, contacts 55, relay 50, and battery to ground.

Relay 50 will not be energized by the above circuit when the counting relay 40 is first operated

since contacts 39 are open until relay 30 restores at the conclusion of the pulses comprising the first digit. Consequently, relay 50 will be operated only after relay 30 restores.

If the particular embodiment shown should be adjusted at potentiometer 57 to allow the tube 35 to fire after two pulses, it is apparent that the tube would also fire for more than two pulses and would operate relay 40. In order to prevent relay 50 from being operated when relay 40 is energized by more than the desired number of pulses provision is made as explained hereinafter.

If relay 40 has pulled up and there are then pulses additional to the number for which the circuit is set to respond, the operation of relay 20 on the excess pulse or pulses closes its contacts 24 and 25 which applies a reverse voltage to condenser 29 through relay 40, contacts 41 and 42 as follows: ground, battery 49, resistor 48, contacts 42, contacts 25, condenser 29, contacts 24, contacts 41, and ground. This returns the grid of tube 35 to a negative potential still lower than its normal standby potential and thus the relay 40 is quickly knocked back down again. When this occurs the contacts 43 are opened and relay 50 is prevented from operating on the subsequent release of relay 30.

If the potentiometer 57 is set so that tube 35 fires on a digit such as 3, for example, and three pulses are received, relay 40 is energized and closes its contacts 41, 42, and 43. A few moments later relay 30 releases and closes its contacts 32, 36, 37, and 39 to complete the following circuit for the operation of relay 50: ground, charged condenser 14, contacts 39, contacts 43, contacts 55, relay 50, and battery to ground. Relay 50 then completes a locking circuit for itself over its "X" contacts 51.

When relay 50 locks its contacts 52 and 54 are closed and 53 and 55 opened. This completes circuits whereby potentiometer 67 determines the response to the second series of digit pulses and relay 60 is operated in the event the number of pulses are received for which potentiometer 67 is set. If this happens a circuit analogous to the one which operated relay 50 is completed for the operation of relay 60 which locks up over its "X" contacts 61 and prepares circuits for the operation of relay 70 at its contacts 64 and for the operation of potentiometer 73 at its contacts 62.

The setting of potentiometer 73 determines the number of pulses which will result in the operation of relay 70. The operation of this relay completes a circuit for the operation of an alarm signal such as bell 80 through the contacts 72.

If the first digit of a particular number is called relay 50 will be energized and will lock. In the event the proper subsequent digits are not dialed relay 50 remains locked until the carrier ceases at which time squelch relay 90 releases and breaks the locking ground for relay 50 through its contacts 96.

It is obvious that additional recording relays and potentiometers could be used in connection with a selective system employing more than three digits.

In order to insure that condensers 26 and 29 are completely discharged between digits the following ground circuits are established upon the release of relay 30:

For condenser 26: ground, contacts 36, contacts 23, condenser 26, and ground.

For condenser 29: ground, contacts 36, resistor 44, resistor 45, condenser 29, resistor 47, contacts

53 (or 52—63 or 52—62), potentiometer 57 (or 67 or 73), and ground.

In making an installation of the equipment illustrated the number assigned to the unit is set up by adjustment of the potentiometers 57, 67, and 73. For example, if the number assigned to the unit were 234, potentiometer 57 would be adjusted to enable two pulse charges on condenser 29 to overcome the bias of tube 35, potentiometer 67 would be adjusted for three digit pulses, and potentiometer 73 for four. In accordance with the explanation previously given relays 50, 60 and 70 would be successively operated and locked only upon the pulse sequence 2, 3, and 4.

The diagram illustrated would operate successfully with a wide variety of condensers and resistors. Values for condensers and resistors are given below opposite the number of the part shown on the drawing merely to show the approximate degree of difference among values and are not to be construed as a limitation of the invention.

Number:		Value
13	ohms	5,000
27	do	10,000
28	do	5,000
14	mf	2
26	mf	2
29	mf	2
44	megohms	2
45	do	2
46	do	2
47	ohms	100,000
48	do	5,000
57	do	50,000
58	do	10,000
59	do	10,000
67	do	50,000
68	do	2,000
73	do	50,000

The variable resistor 27 is adjusted to a fixed rate of charge for condenser 26. After the resistor 27 has once been set for proper operation further adjustment is unnecessary.

A general call to all of the units in the system may be had by replacing the dialed pulses by three sustained pulses. Each sustained pulse places a charge of sufficient magnitude on condenser 26 that on the subsequent equilibrium of condensers 26 and 29 between pulses condenser 29 acquires sufficient charge to fire tube 35 and operate relay 40. These successive long pulses are reflected in the successive operation of relays 50, 60, and 70 at all stations.

While the invention has been described with reference to a single example, it is not the intention to limit the scope thereof other than as necessitated by the appended claims.

I claim as my invention:

1. A selective signaling receiver unit comprising a pulse receiving means, a pulse relay connected to said pulse receiving means and energized responsive to the pulsing thereof, a slow-release relay energized by closure of contacts of said pulse relay, a negatively biased electron tube, a first condenser connected to the grid of said tube and disposed to overcome the negative bias of said tube, a second condenser for charging said first condenser, a charge circuit for said second condenser responsive to said pulse relay whereby said second condenser is charged during pulses, a discharge circuit for said second condenser connecting said second condenser to said first condenser, a plurality of potentiometers for

varying the charge on said first condenser necessary to overcome the bias of said tube, a counting relay which is energized by the firing of said tube, a plurality of recording relays with contacts disposed to switch said potentiometers into the circuit of said first condenser in a predetermined order, a recording circuit for operating said recording relays in a predetermined order responsive to a particular series of pulses, said recording circuit being completed by contacts of said counting relay upon the energization thereof in cooperation with contacts of said slow-release relay upon the deenergization thereof, a source of electrical energy for energizing said tube and relays and charging said condensers, and a signaling means responsive to the operation of the last to operate of said recording relays.

2. A selective signaling receiver unit comprising a means for receiving digital pulses, a pulse relay connected to said means and energized responsive to the pulsing thereof, a slow-release relay energized by closure of contacts of said pulse relay, a negatively biased electron tube, a first condenser connected to the grid of said tube and disposed to overcome the negative bias of said tube, a second condenser for charging said first condenser, a charge circuit for said second condenser responsive to said pulse relay whereby said second condenser is charged during pulses, a discharge circuit for said second condenser connecting said second condenser to said first condenser whereby said second condenser partially discharges into said first condenser between pulses, means for discharging said condensers after each series of pulses constituting a digit, a plurality of potentiometers for varying the charge on said first condenser necessary to overcome the bias of said tube, a counting relay which is energized by the firing of said tube, a plurality of recording relays with contacts disposed to switch said potentiometers into the circuit of said first condenser in a predetermined order, a reverse charging circuit for said first condenser responsive to contacts of said counting relay and said pulse relay effective to reverse the charge on said first condenser in the event more than a predetermined number of digital pulses are received, a recording circuit for operating said recording relays in a predetermined order responsive to a particular series of digital pulses, said recording circuit being completed by contacts of said counting relay upon the energization thereof in cooperation with contacts of said slow-release relay upon the deenergization thereof, a source of electrical energy for said unit, and a signaling means responsive to the operation of the last to operate of said recording relays.

3. A selective receiver unit for receiving digital pulses, said unit having a pulse relay disposed to be energized by said digital pulses, a negatively biased grid-controlled vacuum tube, a first condenser connected to the grid of said tube to overcome the negative bias when a sufficient charge is built up on said first condenser, a second condenser and charging circuit which charges said second condenser during digital pulses, a discharge path from said second condenser to said first condenser whereby the charge of said second condenser is in part passed to said first condenser during the time interval between each pulse of each series of pulses constituting a digit, potentiometer means in the circuit of said first condenser for adjusting the firing of said tube to a predetermined series of pulses, a counting relay operated by the firing of said tube, record-

ing relay means operated in response to said counting relay; and an alarm signal operated by said recording relay means.

4. In a selective signaling receiver unit, a pulse relay disposed to be energized by digital pulses, a slow-release relay energized by contacts of said pulse relay, a grid-controlled vacuum tube with a negative bias, a first condenser connected to the grid of said tube for overcoming said negative bias, a second condenser connected to said first condenser through contacts of said pulse relay which are open during pulsing, a charging circuit for said second condenser through contacts of said pulse relay which are open between pulses, potentiometer means connected to said first condenser for adjusting the level at which said first condenser becomes sufficiently charged to fire said tube whereby said tube may be fired by a predetermined series of pulses, a counting relay energized by the plate current of said tube, recording relay means, a recording relay circuit completed by contacts of said counting relay upon the energization thereof, and by contacts of said slow-release relay upon the deenergization thereof, and a signal operated by said recording relay means.

5. In a selective signaling receiver unit, a pulse relay disposed to be energized by digital pulses, a slow-release relay energized by contacts of said pulse relay, a grid-controlled vacuum tube with a negative bias, a first condenser connected to the grid of said tube and disposed to be charged in opposition to said bias, a second condenser connected to said first condenser through contacts of said pulse relay which are open during pulsing, a charging circuit for said second condenser through contacts of said pulse relay which are open between pulses, potentiometer means connected to said first condenser for adjusting the level at which said first condenser becomes sufficiently charged to fire said tube whereby said tube may be fired by a predetermined series of pulses, a counting relay energized by the plate current of said tube, a reverse charging circuit for said first condenser, said reverse charging circuit passing through contacts of said counting relay and said pulse relay which are closed when said relays are energized whereby said tube ceases to fire when said pulse relay is operated after said counting relay is operated, recording relay means, a recording relay circuit completed by contacts of said counting relay upon the energization thereof and by contacts of said slow-release relay upon the deenergization thereof, and a signal operated by said recording relay means.

6. In a selective signaling receiver unit, a pulse relay disposed to be energized by digital pulses, a slow-release relay energized by contacts of said pulse relay, a counting relay, means for operating said counting relay after a predetermined number of pulses through said pulse relay, a deenergizing circuit for said counting relay, said deenergizing circuit being completed by contacts of said counting relay and said pulse relay upon energization of both of said relays whereby said counting relay is released if an additional pulse passes through said pulse relay after said counting relay has been operated, recording relay means, a recording relay circuit completed by contacts of said counting relay upon the energization thereof and by contacts of said slow-release relay upon the deenergization thereof, and a signal operated by said recording relay means.

7. A selective signaling receiver unit compris-

ing a pulse receiver, a pulse relay energized by pulses received by said pulse receiver, a slow-release relay energized by contacts of said pulse relay upon operation thereof, a negatively biased grid-controlled vacuum tube, a first condenser connected to the grid of said tube with the positively charged plate disposed in opposition to the negative bias of said tube, a second condenser, a charging circuit for said second condenser, a discharge circuit from said second condenser to said first condenser responsive to said pulse relay, a potentiometer in the circuit of said first condenser whereby the charge level of said first condenser for firing said tube may be adjusted, a counting relay energized by the plate current of said tube, a discharge circuit for said first condenser, said discharge circuit being completed by contacts of said counting relay and said pulse relay upon the operation of both said relays whereby said tube ceases to fire and the said counting relay releases when an additional pulse operates the said pulse relay after the said counting relay has been operated, a recording relay, an operating circuit for said recording relay, said operating circuit for said recording relay being closed by contacts of said counting relay upon the energization thereof and by contacts of said slow-release relay upon the deenergization thereof, and an alarm signal operated by contacts of said recording relay.

8. In a selective signaling receiver unit, a condenser, pulse receiving means responsive to incoming pulses for cumulatively adding a successive charge to said condenser for each pulse received, a counting relay, circuit means effective in response to said condenser accumulating a predetermined charge by said successive charges thereon for operating said relay, circuits controlled by said operated counting relay in case a succeeding incoming pulse is received by said pulse receiving means immediately following the operation of said relay for reversing the charge on said condenser, and said circuit means effective in response to the reversal charge on said condenser for restoring said relay.

9. In a selective signaling receiver unit, a condenser; pulse receiving means responsive to the receipt of each one of a series of incoming digits comprising a series of a predetermined number of incoming impulses, corresponding to each digit, for cumulatively adding a successive charge to said condenser for each impulse received; a counting relay, circuit means effective in response to said condenser accumulating a predetermined charge commensurate with each of said incoming digits by said successive charges thereon for operating said counting relay, a slow releasing relay operated in response to the receipt of each of said incoming digits and restored after a time delay in response to the termination of the impulses of each of said digits, a first register relay; a circuit including contacts on said slow releasing relay and said counting relay completed in response to the restoration of said slow releasing relay and the operation of said counting relay for operating said register relay, corresponding to the receipt of the first of said series of digits; a plurality of succeeding register relays, and circuits for each of said plurality of register relays including contacts on said slow releasing relay and said counting relay and said first register relay completed in response to the restoration of said slow releasing relay and the operation of said counting relay for operating

said plurality of register relays in a pre-determined order.

10. In a selective signaling receiver unit having a plural digit call number, a plurality of potentiometers one for each digit of said call number and each potentiometer being set to a resistance commensurate with its corresponding digit in said call number, pulse receiving means operated in response to the receipt of incoming digits corresponding to the digits in said call number, circuit means including a condenser controlled by the operation of said pulse receiving means for cumulatively building up to the charge on said condenser, transfer means for successively connecting each one of said plurality of potentiometers into said circuit means, a single counting relay, and circuit controlling means for operating said counting relay for each digit of said call number each time said condenser is cumulatively built up to reach the value corresponding to the setting of the respective potentiometer.

11. In a selective signaling receiver unit as claimed in claim 10 including a register relay for each digit of said call number, a chain circuit including contacts on all except the last of said register relays for successively operating said register relays in response to the successive operations of said counting relay.

12. In a selective signaling receiver unit as claimed in claim 11 including a transfer circuit controlled by said register relays for successively

rendering said potentiometers effective to control the operations of said counting relay.

13. In a selective signaling receiver unit having a plural digit call number, a single counting relay, pulse receiving means operated in response to the receipt of each of said digits in said call number for operating said counting relay once for each digit of the call number received, a plurality of potentiometers one for each digit of said call number and each potentiometer being set to a value dependent upon the value of its corresponding digit in said call number, and circuit means for successively including each one of said plurality of potentiometers in circuit with said pulse receiving means for successive digits to control the successive operations of said counting relay dependent upon the value of the potentiometer at the time being connected in circuit with said pulse receiving means.

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