

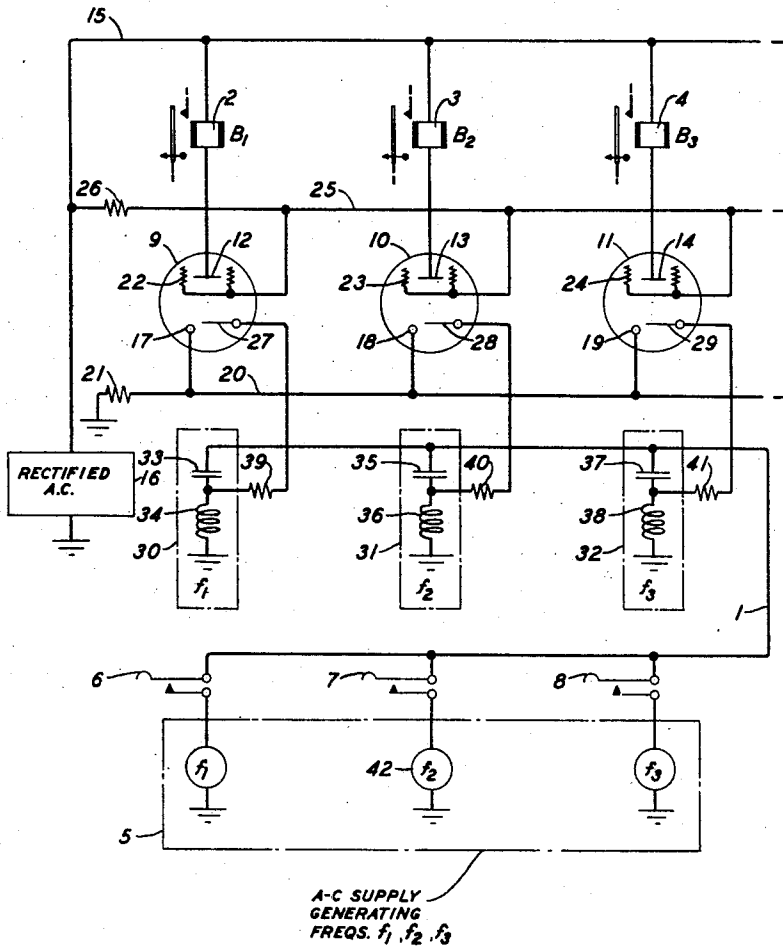
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SELECTING SYSTEM

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SELECTING SYSTEM

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This invention relates to selecting systems and particularly to systems in which distinctive signals are used to make selections in a group of lines, circuits, relays or other electrical devices.

An object of the invention is to obtain a higher degree of selectivity.

Another object is to increase the number of channels that may be derived from a transmission circuit in a system using frequency discrimination as the basis of selection.

Other objects of the invention are to simplify the equipment by means of which these advantages are attained, to reduce the likelihood of false operations; and in other respects to improve selective signaling systems.

These objects are realized by means of a selecting system in which any desired one of a series of relays, magnets, circuits or other equivalent electrical devices, from which selection is to be made, is selectively operated in response to the operation of the corresponding one of a series of individual discharge tubes which in turn is selectively operated by signals of the corresponding one of a plurality of frequencies incoming over a single transmission line, and in which the initial ionization of the desired tube serves to prevent the successful operation of other tubes which may also undergo initial ionization in response to the same incoming signal due to the close proximity of their individual frequencies to that of the incoming signal. More specifically, the incoming transmission line over which the selective frequency signals are transmitted terminates in a plurality of tuned receiving circuits associated individually with the starting gaps of the several discharge tubes. Although each receiving circuit is tuned to produce its maximum voltage in response to its particular corresponding frequency, the frequency channels are purposely spaced so closely that the adjacent receiving circuits also respond and produce voltages which are substantial although somewhat less in magnitude than that produced by the receiving circuit directly tuned to the incoming signal. The maximum voltage thus produced in the receiving circuit corresponding to the transmitted frequency causes the initial ionization of the corresponding tube, and the lesser voltages also produced in the adjacent circuits may cause the simultaneous ionization of the corresponding adjacent tubes in the series. These tubes are all provided with auxiliary or secondary ionization gaps to which a transfer is made as soon as the initial starting gap has reached the proper degree of ionization. Since, therefore, the desired

tube in the series has its initial gap ionized by a voltage of greater magnitude than that which is simultaneously applied to the initial gaps of the adjacent tubes, the desired tube will be the first to transfer its ionization to the auxiliary gap. As soon as this transfer is made, the current flowing in a common lockout circuit serves automatically to prevent any other tube in the series from transferring its ionization to the secondary gap. Thus the desired tube completes its final ionization of the main gap to operate the desired relay or other device, whereas all other tubes which may have undergone ionization in response to the incoming signal are rendered inoperative.

The advantages of this selection system are obvious. In the first place it is possible to greatly increase the number of selective channels that may be applied to a single circuit without increasing the total width of the frequency band. In other words, it is possible to space the channels closely together and yet to insure that only the desired tube shall be operated when a particular signaling frequency is applied to the line. Again, it is possible to dispense with the expensive and complicated tuning circuits that would otherwise be necessary to obtain the desired degree of selectivity with closely spaced frequency channels.

Other features and advantages of the invention will be described more fully in the following detailed specification.

The drawing accompanying the specification illustrates a selection system incorporating the features of this invention.

Although applicable to selecting and controlling systems in general and without regard to the specific purposes for which these systems are used, the invention is disclosed in the drawing in connection with the selection of relays or magnets. While these relays or magnets may be employed for a variety of purposes, they are particularly useful in the operation and control of communication systems, such as telephone systems of the automatic types.

Referring particularly to the drawing, the selection system here disclosed comprises a transmission line 1 over which it is desired to select any one of a large number of relays or magnets 2, 3, 4, etc., by means of signals of distinctive frequencies f_1 , f_2 , f_3 , etc. These signal currents are produced at the sending station by means of any suitable alternating current generator 5. The desired frequency may be connected to the transmission line 1 by any suitable means, such as keys 6, 7, 8, etc.

At the receiving station the series of relays 2, 3,

4 is provided with a corresponding series of individual discharge tubes 9, 10, 11, etc. Each of these tubes is provided with a main anode, a main cathode, a starting anode and a screen grid element. The main anodes 12, 13, 14, are connected respectively to the winding terminals of the associated relays 2, 3, 4, the other winding terminals of these relays being connected over a common conductor 15 to a source of rectified alternating current 16. The main cathodes 17, 18, 19, are connected directly to a common conductor 20 which in turn is connected through a common resistor 21 to ground. The screen grids 22, 23, 24 are connected directly to the multiple conductor 25, which in turn is connected through the common resistor 26 to the source 16. The starting anodes 27, 28, 29 are connected to the individual tuned receiving circuits 30, 31, 32.

These receiving circuits 30, 31, 32 are tuned to the corresponding signal frequencies f_1 , f_2 , f_3 . Each receiving circuit comprises a condenser and an inductive element connected in series; the circuit 30 includes condenser 33 and inductance 34, the circuit 31 includes condenser 35 and inductance 36, and the circuit 32 includes condenser 37 and inductance 38. The condensers are all connected in multiple to the transmission conductor 1, and the inductances may be connected to a ground return conductor as illustrated or to a second conductor returning to the transmitting station. The starting anodes 27, 28, 29, etc., are connected to the receiving circuits as illustrated through suitable resistors 39, 40, 41.

The manner in which the system operates will now be described, assuming that it is desired to selectively operate the relay 3 to the exclusion of all other relays. Since the relay 3 corresponds to frequency f_2 , the key 7 or similar circuit-closing switch is operated at the transmitting station to prepare a circuit for the transmission of current of frequency f_2 over the common transmitting line 1. This circuit may be traced from the source 42, contacts of key 7, conductor 1 and thence to all of the receiving circuits 30, 31, 32 in parallel. Receiving circuit 31 is tuned directly to frequency f_2 , whereas the adjacent circuits 30 and 32 are tuned respectively to the adjacent frequencies f_1 and f_3 . Therefore, current of maximum intensity passes through the condenser 35 and inductance 36 of circuit 31 and over the ground return path to the source 42, while currents of somewhat less intensity flow in parallel through the adjacent receiving circuits 30 and 32. The flow of current in the receiving circuit 31 sets up a potential which is proportional to the intensity of the current and which is applied through the resistor 40 to the control anode 28 of the tube 10. The voltage applied across the starting gap 18—28, the magnitude of which is proportional to the current shown in circuit 31, causes the ionization of this gap. The complete circuit for the application of this voltage may be traced on the one hand from the starting anode 28, resistor 40, inductance 36 to ground and on the other hand from the cathode 18, conductor 20, resistor 21 to ground. At the same time the current flowing in the adjacent receiving circuits 30 and 32 results in the application of voltages of lesser magnitude to the starting gaps 17—27 and 19—29 of the adjacent tubes 9 and 11. In a similar manner the current flowing in the next adjacent receiving circuits (not shown in the drawing) causes the application of voltages of corresponding magnitude to the corresponding tubes.

If the frequency spacing of the channel is made quite narrow for the purpose of enlarging the number of channels available, or, if the receiving circuits are made less discriminatory in their frequency selectivity for the purpose of reducing the cost of the tuned circuits, or, if both of these conditions prevail, then the voltages applied to the adjacent tubes 9 and 11 (and possibly to the next adjacent tubes not shown), while not as large in magnitude as that applied to the tube 10, will nevertheless be sufficient to produce initial ionization in the starting gaps of these adjacent tubes. In other words the application of signal current f_2 to the transmission line 1 results in the ionization of the starting gaps of the desired tube 10 and in the simultaneous ionization of the starting gaps of the undesired tubes 9 and 11 and possibly others.

The next step following the ionization of the starting gap of one of these tubes is to transfer the ionization to the auxiliary gap thereof formed by the cathode and the screen grid element. This auxiliary gap ionizes for the reason that a voltage is applied thereto over the circuit traceable from the source 16 through the common resistor 26, thence in multiple to the screen grid elements of all tubes, across the auxiliary gaps to the cathodes which are similarly multiplied, thence over conductor 20 and resistor 21 to the grounded pole of source 16. However, the ionizing voltage applied to the starting gap of the tube 10 is greater than that applied to the other tubes and the result is that the transfer of ionization to the auxiliary gap takes place in the tube 10 somewhat prior to transfer in the adjacent tubes 9 and 11. The instant the auxiliary gap 18—23 of tube 10 ionizes, current flows from the source 16 through the resistor 26, screen grid 23, cathode 18, conductor 20, resistor 21 to ground. The current flowing in the common resistors 21 and 26 lowers the voltage applied to the auxiliary gaps of all tubes below the value necessary to cause the transfer of ionization to the auxiliary gaps of these tubes. Therefore, tubes 9 and 11, although they have succeeded in ionizing their starting gaps, are prevented from transferring their ionization to the auxiliary gaps, which means that they are prevented from further operation. The flow of current in the common resistors 21 and 26 likewise reduces the voltage applied to the auxiliary gap of the preferred tube 10, but since this tube has already succeeded in transferring its ionization the sustaining voltage of its auxiliary gap is correspondingly reduced to a value which is substantially less than the applied voltage after reduction by the common resistors 21 and 26. Thus the preferred tube maintains the ionization of its auxiliary gap and proceeds immediately to transfer its ionization to the main anode 13. The tube is now fully ionized, and current flows from the source 16 over conductor 15 through the winding of relay 3, anode 13, cathode 18, resistor 21 to ground. Relay 3 operates in this circuit and performs its desired functions. If the source 16 is one that delivers pulsating or alternating current to the system, the relay 3 is held in its energized condition between pulsations by reason of its slow release character. The same, of course, is true of all other relays in the series.

When it is desired to release the operated relay 3, the tube 10 is quenched by opening key 7.

While the space discharge tubes illustrated herein may be of any suitable type and may be filled with gases of different kinds, it has been

found that better results are obtained in the system disclosed when tubes filled with argon are employed.

What is claimed is:

1. The combination in a selecting system comprising a plurality of discharge devices and a plurality of signal receiving circuits, each of which is individual to a corresponding one of said devices, said receiving circuits being tuned respectively to signal currents of a plurality of different frequencies, of a common signal transmitting circuit, a plurality of sources of current of said different frequencies, means for sending over said transmitting circuit current signals of any one of said frequencies to produce a voltage in the correspondingly tuned receiving circuit, circuit means for applying said voltage to the particular discharge device which corresponds to said receiving circuit to initiate the discharge of said particular device, and means responsive to the flow of discharge current in said particular device for rendering the other discharge devices inoperative.

2. The combination in a selecting system comprising a plurality of discharge devices and a plurality of signal receiving circuits each of which is individual to a corresponding one of said devices, said receiving circuits being tuned respectively to signal currents of a plurality of different frequencies, of a common signal transmitting circuit, a plurality of sources of current of said different frequencies, means for sending over said transmitting circuit current signals of any one of said frequencies to produce a voltage in the correspondingly tuned receiving circuit, circuit means for applying said voltage to the particular discharge device which corresponds to said receiving circuit to initiate the discharge of said particular device, and lockout means common to all of said discharge devices and responsive to the flow of discharge current in said particular device for rendering the other discharge devices ineffective.

3. The combination in a selecting system comprising a series of discharge tubes of a common signal transmitting circuit, a plurality of sources of current of different frequencies, means for sending over said transmitting circuit signal currents of any one of said frequencies, a series of signal receiving circuits each of which is individual to one of said tubes, each of said receiving circuits being tuned to produce a voltage of given magnitude in response to current of a particular frequency and voltages of lesser magnitude in response to currents of other frequencies, circuit means for applying to the corresponding tubes the voltages produced in said receiving circuits to initiate the discharge of said tubes when signals of any given frequency are sent over said transmitting circuit, and means responsive to the flow of discharge current in the tube to which the maximum voltage is applied for rendering ineffective all other tubes to which lesser voltages are applied.

4. The combination in a selecting system comprising a series of discharge tubes of a common signal transmitting circuit, a plurality of sources of current of different frequencies, means for sending over said transmitting circuit signal currents of any one of said frequencies, a series of signal receiving circuits each of which is individual to one of said tubes, each of said receiving circuits being tuned to produce a voltage of given

magnitude in response to current of a particular frequency and voltages of lesser magnitude in response to currents of other frequencies, circuit means for applying to the corresponding tubes the voltages produced in said receiving circuits to initiate the discharge of said tubes when signals of any given frequency are sent over said transmitting circuit, means responsive to the initiation of the discharge of the particular tube to which the maximum voltage is applied for completing the discharge thereof, and means common to all tubes and responsive to the discharge of said particular tube for applying an opposing voltage to all tubes to prevent the completion of the discharge of any tube which initiates its discharge in response to an applied voltage of lesser magnitude.

5. The combination in a selecting system comprising a series of discharge tubes, each of which has a starting gap, an auxiliary gap and a main gap, of a common signal transmitting circuit, a plurality of sources of current of different frequencies, means for sending over said transmitting circuit signal currents of any one of said frequencies, a series of signal receiving circuits each of which is individual to one of said tubes, each of said receiving circuits being tuned to produce a voltage of given magnitude in response to current of a particular frequency and voltages of lesser magnitude in response to currents of other frequencies, circuit means for applying to the starting gaps of the corresponding tubes the voltages in said receiving circuits to initiate the ionization of said tubes when signals of any given frequency are sent over said transmitting circuit, means for causing the initial ionization of any tube to transfer from the starting gap to the auxiliary gap thereof, the particular tube to which the maximum ionizing voltage is applied from the associated receiving circuit being the first one to transfer its ionization to its auxiliary gap, a lockout circuit common to the auxiliary gaps of all tubes in the series and responsive to current flowing as a result of the ionization of the auxiliary gap of said particular tube for applying an opposing voltage to all other tubes to prevent the corresponding transfer of ionization in any other tube which may have ionized its starting gap simultaneously with the starting gap of said particular tube, and means for causing the ionization of said particular tube to transfer to the main gap thereof.

6. The combination in a selecting system comprising a series of discharge tubes of a common signal transmitting circuit, a plurality of sources of current of different frequencies, means for sending over said transmitting circuit signal currents of any one of said frequencies, a series of signal receiving circuits each of which is individual to one of said tubes, said frequencies being so spaced and said receiving circuits so tuned that signal current of any given frequency produces a maximum voltage in the receiving circuit tuned to that frequency and voltages of lesser magnitude in the adjacent receiving circuits, circuit means for applying to the corresponding tubes the voltages produced in said receiving circuits to initiate the discharge of said tubes, and means responsive to the flow of discharge current in the tube to which the maximum voltage is applied for rendering ineffective all other tubes to which lesser voltages are applied.

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