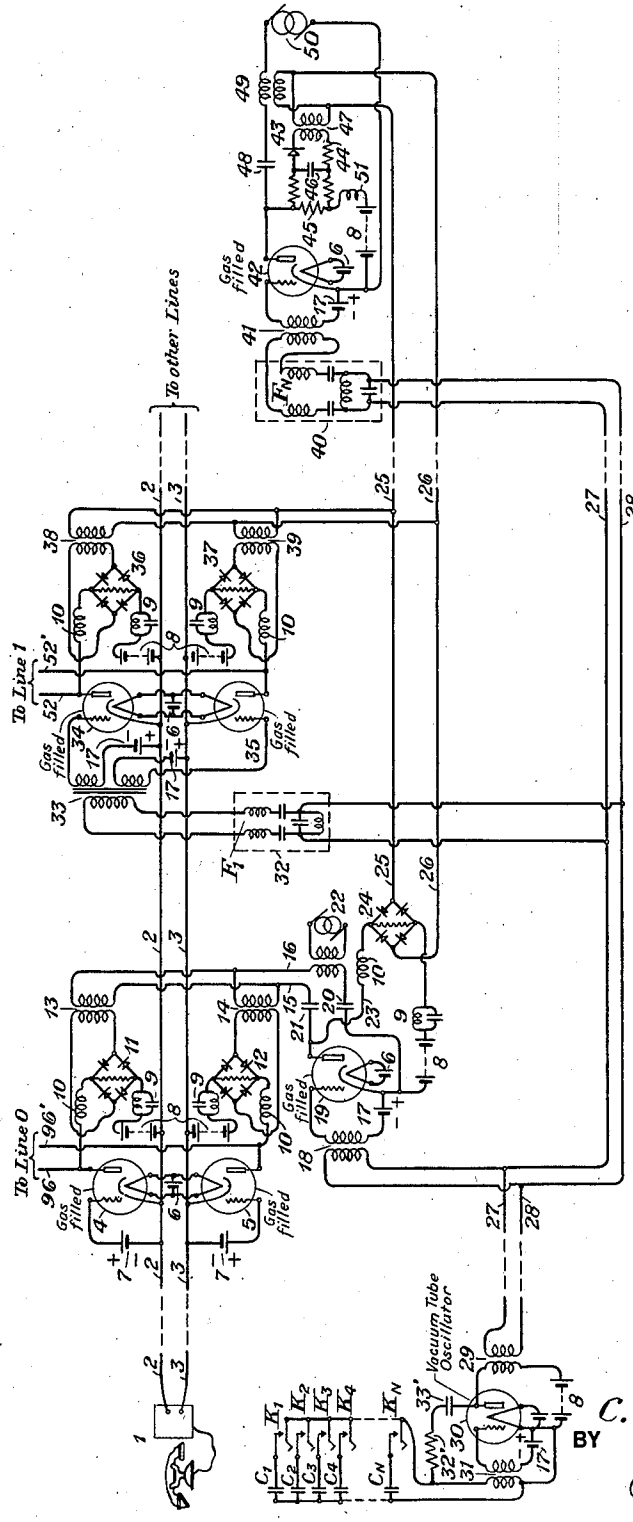
April 28, 1936. C. S. DEMAREST 2,038,649

SELECTIVE SIGNALING SYSTEM

Filed Oct. 13, 1932



Patented Apr. 28, 1936 2,038,649

UNITED STATES PATENT OFFICE

2,038,649

SELECTIVE SIGNALING SYSTEM

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Application October 13, 1932, Serial No. 637,650

3 Claims. (Cl. 177—353)

This invention relates to electrical circuits, and more particularly to circuits for selecting signaling or switching, in which a signal may be transmitted selectively to one of a plurality of circuits or a circuit may be connected selectively to one of a plurality of circuits.

Such arrangements have heretofore been provided by the use of electromagnetically operated relays or selector switches, involving mechanical motion of some parts thereof. These moving parts have required careful adjustment and maintenance and troubles have also been experienced at the points of electrical contact as films of dirt or corrosion may impair the electrical contact to such an extent that the circuit becomes noisy or actually is not completed. It is an object of this invention to provide means whereby such selective switching or signaling operations may be carried out without the use of electro-mechanical devices such as relays or selectors. I have described such a system in my copending application, Serial No. 629,382, filed August 18, 1932, Patent No. 1,908,326, from which this invention is differentiated by the method of selection employed. In the above mentioned application, selection is made by the use of a train of coded impulses. In this invention, however, I have utilized electrical tuned circuits, together with a source of signaling current of adjustable frequency, so that by sending current of a particular frequency one of a plurality of circuits is selected. Obviously, it would be possible to combine the features of this invention with that already referred to so as to increase the number of stations or circuits available for selection, the first selection being made by selecting the proper frequency, after which coded impulses of this frequency select a particular circuit from the group first selected.

Other objects and purposes of this invention will appear from the following description together with the accompanying drawing in the figure of which is shown a circuit diagram embodying a preferred form of the invention.

Referring to the drawing, reference character 1 indicates the subscriber's station and its associated line conductors 2 and 3, connecting it to the gas-filled tube switching equipment at the central office. Tubes 4 and 5 are so arranged that line conductors 2 and 3 are normally connected to the conductors 96 and 96' of line O through the arc paths of these tubes. Grid batteries 7 for these two tubes are poled so that the grids are normally positive and hence an arc established. Thus if none of the keys K_1 . . . K_N are operated, a connection may be established between the subscriber's station 1 and an operator over lines 96 and 96'. Signaling impulses are sent from keys K_1 to K_N over conductors 27 and 28, the current for such impulses being supplied by the vacuum tube oscillator composed of vacuum tube 30, output transformer 29, condenser 33', resistance 32', oscillator coil 31 and the tuning condensers C_1 to C_N. Depressing any key K_1 to K_N connects the appropriate condenser across the oscillator coil and causes a predetermined frequency to be transmitted over signaling pairs 27 and 28. Obviously these conductors 27 and 28 might be the same conductors as 2 and 3, separation of the selecting currents from the other currents transmitted over conductors 2 and 3 being made by proper choice of selecting frequencies and the provision of suitable filters. An untuned transformer 18 is connected with its primary bridged across the signaling pair and its secondary connected to the grid and cathode of gas-filled tube 19. The grid of this tube is normally biased negatively by battery 17. It should be noted that the same reference character has been used for batteries, coils and the like of identical function associated with different parts of the circuit. Upon the application of any signaling current of frequency F_1 to F_N, an arc will be established in tube 19. Upon the striking of this arc, current will flow from alternator 22 to the primary of transformer 16. Current will flow from the secondary thereof through the primaries of transformers 13 and 14 in parallel, over conductors 16 and 15, through condenser 21, anode of tube 19, through the arc to the cathode, and thence through condenser 20 back to the secondary of transformer 16. The secondaries of transformers 13 and 14 are connected to the rectifier resistance units 11 and 12 in the anode circuits of tubes 4 and 5. These rectifiers are so poled that the resulting electromotive force across the resistance elements will oppose the anode batteries 8 and extinguish the arc in the tubes 4 and 5, thus disconnecting line 0. Choke coils 10 and resonant circuits 9 keep the alternating current from generator 22 out of the transmission circuit over conductors 2 and 3. At the same time the signaling current applied over conductors 27 and 28, which is of one of N predetermined frequencies F_1 to F_N will actuate the corresponding set of connector tubes, of which only one set, the F_1 group, has been indicated in the drawing. Supposing that the frequency sent out is F_1, due to operation of key K_1 at the station, the condenser C_1 will be connected to the oscillator coil 31 and cur-

rent of frequency F_1 will be applied to conductors 27 and 28. This current will be passed by selective network 32, but rejected by all others. As a result, in addition to quenching tubes 4 and 5 as hereinbefore explained, alternating current from vacuum tube oscillator 30 will be applied to the primary of transformer 33 and the voltages induced in the secondaries of this transformer will cause arcs to be established in gas-filled tubes 34 and 35, the positive half cycles being sufficient to override the effect of biasing batteries 17. When the arcs have struck it is apparent from the drawing that a circuit is established from conductors 2 and 3 to conductors 52 and 52' of line 1.

If another key, say K_3, be now pressed, a double connection to both lines 1 and 3 would be established. If, however, it is desired to establish another single connection, key K_N must first be operated sending out frequency F_N. It will be apparent that tube 42 will be operated, as voltage of this frequency F_N will be applied to the grid of tube 42 through selective network 40 and transformer 41. Direct current will flow from battery 8 through inductance 51, resistance 45 to the anode of tube 42, through the arc thereof and back to battery 8. At the same time an A. C. path from generator 50 will be completed through the primary of transformer 49, condenser 48, the arc path of tube 42 and back to generator 50. Alternating current will flow from the secondary of transformer 49 over conductors 25 and 26, to rectifier resistance network 24, and will after rectification build up a direct potential opposing the anode battery of tube 19, thereby quenching this tube and permitting gas-filled tubes 4 and 5 to again establish an arc, thus restoring the connection to line 0. At the same time alternating current will flow from conductors 25 and 26 into the primaries of transformers 38 and 39. The anode circuits of the connector tubes 34 and 35 contain rectifier and resistance elements 36 and 37, connected to the secondaries of transformers 38 and 39. The direct potential built up across the resistances of these rectifier-resistance units will oppose the anode batteries of tubes 34 and 35 and thus quench the arcs therein, so disconnecting conductors 2 and 3 from line 1.

At the same time transformer 47 has supplied an A. C. potential to rectifier 43, and this will slowly charge up condenser 46, through resistance 44, and in such a manner as to oppose the voltage of the anode battery 8 of tube 42. After a period predetermined by the amplitude of the voltage supplied from the secondary of transformer 47, the values of resistances 44, 45 and of capacity 46, this voltage will be sufficient together with the potential of the negative half cycles of the alternating voltage to quench the arc in tube 42. The system is thus restored completely to its normal condition.

It is obvious that conductors 27 and 28 could be made the same as conductors 2 and 3 as above stated by providing additional filtering. If this is done, the signaling current from generator 30 may be applied to the circuits 0, 1, etc., selected on a frequency basis. If now these line conductors be arranged to serve as the input circuit to a selective system of the type shown in my above identified patent, and if pulses of the frequency sent out by generator 30 be sent, instead of a single signal, selection of further lines may be made on a coded impulse basis, making it possible to greatly multiple the number of selections possible.

While this invention has been described with regard to a particular embodiment thereof, it is not to be regarded as limited to the specific arrangements disclosed, but includes any and all organizations falling within the scope and spirit of the appended claims.

What is claimed is:

1. In a signaling system, selectively operated switching means comprising a plurality of gas-filled tube devices each having input and output circuits, each of said devices having plate voltages sufficient to maintain the devices in discharging condition after they are initially broken down and started in discharging condition, extinguishing means associated with the output circuits of each of said tube devices for changing said plate voltages so that they will be insufficient to maintain the devices in discharging condition, the first of said gas-filled tube devices being normally adjusted to be in a discharging condition, filtering devices adapted to transmit different frequencies associated with the input circuits of all of said tube devices except said first tube device, a multi-frequency source, switching means for applying currents of different frequencies from said source to said filtering devices to selectively cause the discharge of said tube devices, means directly controlled by any of the currents from said source for operating the extinguishing means associated with said first gas-filled tube device, switching means for applying current of a definite frequency from said source to the last one of said gas-filled tube devices to cause the operation of said last tube device, and means controlled by the operation of said last tube device for operating the extinguishing devices associated with all of said tube devices except said first tube device.

2. In a signaling system, selectively operated switching means comprising a plurality of gas-filled tube devices each having input and output circuits, each of said devices having plate voltages sufficient to maintain the devices in discharging condition after they are initially broken down and started in discharging condition, extinguishing means associated with the output circuits of each of said tube devices for changing said plate voltages so that they will be insufficient to maintain the devices in discharging condition, the first of said gas-filled tube devices being normally adjusted to be in a discharging condition, filtering devices adapted to transmit different frequencies associated with the input circuits of all of said tube devices except said first tube device, a multi-frequency source, switching means for applying currents of different frequencies from said source to said filtering devices to selectively cause the discharge of said tube devices, means directly controlled by any of the currents from said source for operating the extinguishing means associated with said first gas-filled tube device, switching means for applying current of a definite frequency from said source to the last one of said gas-filled tube devices to cause the operation of said last tube device, means controlled by the operation of said last tube device for operating the extinguishing devices associated with all of said tube devices except said first tube device, and slow-operating means associated with and controlling the operation of the extinguishing means of said last one of said gas-filled tube devices.

3. In a signaling system, selectively operated switching means comprising a plurality of gas-filled tube devices each having input and output circuits, each of said devices having plate voltages sufficient to maintain the devices in discharging

condition after they are initially broken down and started in discharging condition, extinguishing means associated with the output circuits of each of said tube devices for changing said plate voltages so that they will be insufficient to maintain the devices in discharging condition, the first of said gas-filled tube devices being normally adjusted to be in a discharging condition, filtering devices adapted to transmit different frequencies associated with the input circuits of all of said tube devices except said first tube device, a multi-frequency source, switching means for applying currents of different frequencies from said source to said filtering devices to selectively cause the discharge of said tube devices, an auxiliary gas-filled tube device for controlling the extinguishing means of said first normally operated gas-filled tube device having its input circuit connected to said multi-frequency source and adapted to be broken down and discharged by currents of any of the frequencies transmitted from said source, extinguishing means associated with the said auxiliary gas-filled tube device, switching means for applying current of a definite frequency from said source to one of said gas-filled tube devices to cause the operation of said last mentioned tube device, and means controlled by the operation of said last tube device for causing the operation of the extinguishing devices associated with said auxiliary gas-filled tube and all of said gas-filled tube devices except said first gas-filled tube device.

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