

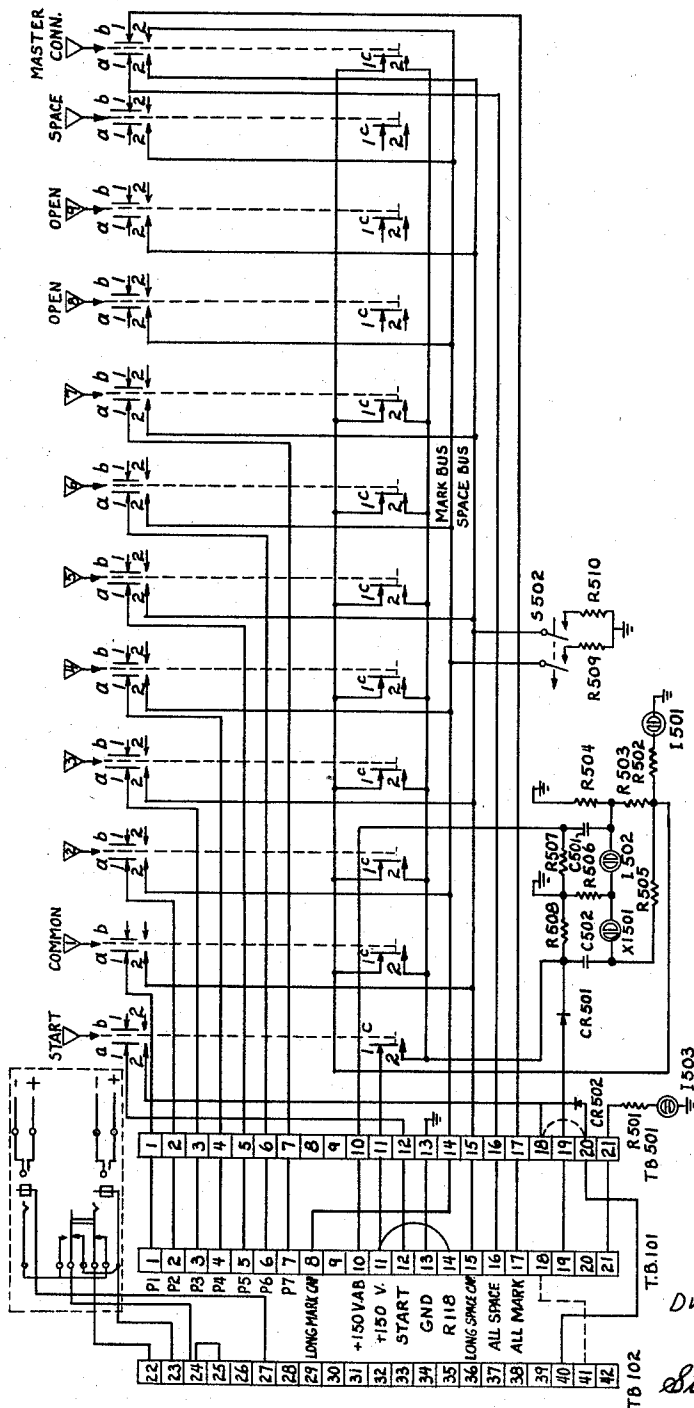
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1 Claim. (Cl. 340—313)

The present invention relates to remote switching systems which basically comprise a sender, a sender control (push-button key cabinet for coding the sender) and a receiver and more particularly to improvements on the sender control unit of such systems.

General description

The usual application of such systems calls for a receiver at one or more remote locations, and a sender and associated push-button sender control cabinet at one or more control locations, with all locations being interconnected by at least the equivalent of a telegraph or teletypewriter circuit. Functions at remote locations can then be performed by operating push-buttons at control locations. In the commercial embodiment of these systems, each receiver will respond to six individual code signals which are common to all receivers. The four common code signals normally are used for a Master Disconnect, a Master Connect, and two Group codes.

With the addition of one external relay, one receiver can be made to respond to fourteen individual and four common codes, while with the addition of three external relays one receiver can be made to respond to sixty-four different codes. One sender, under the control of the push-button sender control units, has the available capacity to generate one hundred twenty-eight different codes. The push-button control cabinets (sender control units) as disclosed in my copending application Serial No. 601,320 filed July 31, 1956 for Remote Switching System have one push-button key and a lamp for each code to be sent. The basic sender control unit has ten such function buttons and lamps. It has, in addition, a Master Disconnect (DISC) key for sending the code for disconnecting any previously activated remote functions and it has a reset (RSET) key for clearing out or resetting the lamp tally.

The system employs a noncoded Answer-Back signal whereby any receiver which successfully performs a function, sends a short space signal to the line as an Answer-Back. This signal, when received at the sender, lights the lamp over the push-button that was pressed to send out the signal. This lamp remains lighted until the Disconnect code is sent, and an Answer-Back signal to this code is received at the sender.

When the system operates on a circuit used alternately for teletypewriter signals, the average time of signaling is 2.0 seconds long and the maximum code is 2.4 seconds long. When the system operates on a circuit not used alternately for teletypewriter service, modifications can be made within the units so the lengths of the code signals can be cut approximately in half.

Each code signal transmitted by the sender consists

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of four "opens" or space signals on the line. These are called space pulses, and each signal includes four space pulses.

The interval between two space pulses on a line is necessarily a marking condition. The mark intervals between the space pulses of a code signal are called mark pulses. The condition of the line before the code signal starts will be marking, and the condition of the line after the code signal ends is marking. The code signal then consists of interrupting the steady state marking condition of the line with the first space pulse of the code signal, followed by a mark pulse, then the second space pulse, another mark pulse, the third space pulse, and third mark pulse, followed by the fourth space pulse and then the final steady state marking condition of the circuit.

In the basic code signal, the duration of each of the space and mark pulses is approximately sixty milliseconds.

The pulses are numbered consecutively from the beginning of the signal. The space pulses are therefore 1, 3, 5 and 7, and the mark pulses are 2, 4 and 6. Since the space pulses are always the odd numbered ones, and the mark pulses are the even numbered ones, reference to pulses will be made by number only, there being no need for making the further statement that a pulse is a mark or a space.

For selective signaling purposes each code signal, of course, must be different from every other code signal. This difference among the signals, or the adding of intelligence to the basic signal, as it might be called, is obtained by making one or more of the pulses of each code signal a long pulse (400 milliseconds) instead of the basic short length of approximately 60 milliseconds.

Intelligence is added to the basic code signal by lengthening both the space and mark pulses in various combinations. Since there are seven pulses which can be lengthened, the total number of combinations possible is two to the seventh power or one hundred twenty-eight. If more pulses were used, the number of combinations possible would be 512 for nine pulses, 2048 for eleven pulses and so on.

It should be noted that the overall duration of each code signal depends upon the number of pulses in it which are long pulses, and thus the overall lengths of the various code signals will not be the same. This, of course, contrasts with the usual teletypewriter code signal where the length of each code signal or character is the same.

In the application of the system to teletypewriter circuits, Pulse 1 is always a long pulse, for reasons concerned with the blinding of teletypewriters on the circuit. This is so that the pulses of a code signal do not cause printing on any teletypewriters that may be connected to the circuit during the sending of a code signal. Since this pulse is always long, there is no necessity for mentioning it in reference to the code signals.

The basic system is one in which no additional relays are added to a receiver to increase the number of codes to which it will respond beyond the minimum of six individual and four common codes. The codes used in the basic system are as follows: 2, 3, 4, 5, 6, 7, 23, 24, 25, 26, 27, 34, 35, 36, 37, 45, 46, 47, 56, 57, 67, 234, 235, 236, 237, 245, 246, 247, 256, 257, 267, 34567, 234567, and the code in which Pulses 2 through 7 are short. The members each refer to the pulse or pulses in the

code which are long pulses (400 milliseconds) compared to the normally short (approximately 60 milliseconds) for a pulse. Pulse 1 is assumed to be long in all codes.

The possibility is remote that a code signal will be so changed in transmission that the station for which it is intended will not respond, and that a station for which it is not intended will respond. This margin of safety results from the large difference in the lengths of the short and long pulses of a code. A large amount of distortion would have to be present before a short pulse, approximately sixty milliseconds in length, could be lengthened to appear as a long pulse four hundred milliseconds in length, or vice versa. Either a fairly long spacing hit or a close-down of the line circuit would have to occur to cause such an effect. In the case of either of these conditions, it is probable that the same condition would obliterate one or more pulses of the code signal and no receiver on the line would receive sufficient pulses to operate any function. Therefore, an Answer-Back signal would not be returned to the sender and a repetition of the code signal would be required.

For a more detailed explanation of the general system, reference is made to United States Patent No. 2,708,744 issued May 17, 1955 to J. T. Neiswinter for Selective Signaling System and to his copending application Serial No. 324,765, now abandoned, filed December 8, 1952 for Electrical Signalling Systems.

The present invention relates to sender controls for selective switching systems of the above described type. The sender control unit disclosed in the aforesaid copending application embodies a push-button arrangement which from the operator's viewpoint results in the maximum in simplicity and rigidity of performing remote selections in that each push-button is wired to effect transmission of but a single code group. This apparatus becomes quite large when selection among a large number of possible code groups must be made. In certain installations in which selection among a large number of possible selections must be made, a provision of a push-button individual to each selectable code group results either in an installation at the operator's station which is too bulky for the space available or which is too expensive.

The present invention provides a sender control unit in which an individual key is associated with each unit of the code group so that by actuation of the keys individually or in any combination, any possible code group can be selected for transmission, which is effective to provide a record in the form of latched keys of the code selected prior to actual transmission and until the selection of a subsequent code is initiated to thereby assure accurate code selection and transmission by the operator, and which is effective to provide an indication for the operator of the successful performance at the remote receiving station of the function selected. Due to its flexibility in code selection and maintenance of a record of the code selection, the control unit of the present invention is a very useful tool in trouble shooting selective switching systems of the foregoing described type.

The primary object of the present invention is to provide a sender control unit for a time duration coded signal actuated selective switching system having a plurality of selectively settable circuit devices equal in number to the number of variable units of the code group of this system and each individually associated with a distinct one of the units of such code group whereby any possible code group can be selected by the selective actuation of said circuit devices individually and in combination.

A further object of the present invention is to provide a sender control unit for a time duration coded signal actuated selective switching system having a plurality of selectively actuatable circuit devices, one associated with a distinct one of each of the units of the code group of this system, indicating means associated with each circuit

device to indicate the actuated condition of any of said circuit devices, means distinct from said circuit devices for initiating transmission of time duration coded signals under control of the actuated ones of the circuit devices, means for indicating the initiation of transmission, and means for indicating effective reception of the transmitted signal.

These and other objects of the present invention will become more fully apparent by reference to the appended claims and as the following detailed description proceeds the reference to the accompanying drawings wherein:

The figure is a schematic circuit diagram of the circuit of the sender control of the present invention.

The sender control unit includes a plurality of push-button controlled switches designated Start, 1 through 9 inclusive, Spare, and Master Conn. Each of these push-button switches are so constructed that they may be depressed without latching or, by slight lateral movement of their stems, may be latched individually in their depressed position to maintain the contacts thereof in their transferred position. Reverse lateral movement of a latched push-button permits it to return to its undepressed position under the effect of spring bias. These push-buttons are mechanically independent so that the depression or release of any one has no mechanical effect on the others.

Associated with each of the push-button controlled switches, Start, 1 to 9, Spare, and Master Conn. are three movable contacts *a*, *b* and *c*. Each of these movable contacts coacts with a pair of stationary contacts designated 1 and 2. Whenever any of these push-buttons is depressed and while it is latched in its depressed position, both its *a* and its *b* movable contacts establish the direct electrical connections between the 1 and 2 fixed contacts associated therewith. Each movable *c* contact, during its movement toward its fully depressed position and during its restoration movement from its fully depressed position momentarily establishes a direct electrical connection between the associated 1 and 2 contacts. The purpose of this will become apparent presently.

The present system utilizes a seven unit code, push-button switches 1 to 7 being associated with the first to seventh units of the code respectively and switches 8 and 9 being available for expansion if a code having a greater number of units should become necessary. The stationary contact 2 associated with movable contact *a* of switches 1, 3, 5 and 7 are connected in common to pin 15 of TB501 which in turn is connected to pin 15 of TB101 of the sender unit. The stationary contacts 2 associated with the movable *a* contacts of switches 2, 4 and 6 are connected in common to pin 14 of TB501 which in turn is connected to pin 8 of TB101 of the sender unit. The stationary contacts 1 associated with each of the movable *a* contacts of push-button switches 1 through 7 are connected respectively to pins 1 through 7 of TB501 which in turn are connected to pins 1 through 7 respectively of TB101 of the sender unit. The connection of pin 15 of TB501 to pin 1, 3, 5 or 7 of TB501 by the actuation of push-button switches 1, 3, 5 or 7 respectively is effective to control the long pulse timer circuit and space timer circuit of the sender unit to convert code units 1, 3, 5 or 7 respectively to long pulses. Similarly the connection of pin 14 of TB501 to pin 2, 4, or 6 of TB501 by the actuation of push-button switches 2, 4 or 6 respectively is effective to control the long pulse timer circuit and the mark timer circuit of the sender unit to convert code units 2, 4 or 6 respectively to long pulses. The circuits of the sender unit are fully disclosed in the aforesaid copending application Serial No. 324,765 to which reference is made in the event a more detailed explanation is found to be necessary.

The master connect switch, when depressed, is effective to connect pins 14 and 15 of TB501 to pins 17 and

16 respectively. This is effective to so control the sender unit that all mark and all space impulses are long.

The actual transmission of a coded signal by the sender unit does not take place until the Start key is depressed after the desired code is set up. When the Start key is depressed, its movable (a) contact connects its stationary 1 and 2 contacts associated therewith to interconnect pin 12 of TB501 directly with pin 18 of TB501 and with pin 20 of TB501 through blocking diode CR502. Pin 20 of TB501 is connected to sender terminal 40 (TB102). Depression of the Start key impresses positive 150 volts from pin 40 (TB102) through CR502 upon start terminal 12 of TB101 of the sender unit to initiate transmission of the selected code.

If the start key is latched in its depressed position, it is effective to initiate repeat transmission of the selected code group until it is released.

In order to provide an indication of whether a selected code group has been transmitted and the function selected performed, an answer back storage device is provided. This storage device consists of a pair of neon gas tubes XI501 and I502 connected as a bistable circuit device.

This gas tube trigger double stability circuit device is formed by a pair of neon lamps designated XI501 and I502. The XI501 lamp is preferably a high pressure neon filled lamp, type NE-96, and the lamp designated I502 is preferably relatively low pressure neon filled lamps of good visible indicating quality, type NE-51. The type NE-96 tube has a firing potential of 135 plus or minus 15 volts and a sustaining potential of 75 plus or minus 10 volts and is selected for its relatively high voltage differential between its firing and sustaining potentials whereas the type NE-51 tube has a firing potential of 75 plus or minus 15 volts and a sustaining potential of 65 plus or minus 15 volts and is selected for its good indicating qualities. Due to the inherent characteristics of the circuit in which they are connected, when the set is first turned on or when power is resumed after having been interrupted or intentionally turned off, the indicator lamp I502 will fire and lamp XI501 will be extinguished.

In order that the lamps may serve as function activation record elements as well as Answer-Back indications, a storage action must take place. Once a lamp is lighted it must remain lighted after the activation pulse subsides so that the pulsing source can be routed to other lamps for their subsequent activation.

The neon glow lamp exposed to view as an Answer-Back indicator is the I502 lamp, type NE-51. This type of lamp, acting alone on its differential between fire and sustain values of voltage, is not a reliable storage device. However, when paired with the high gas pressure neon glow lamp type NE-96, the combination becomes a reliable storage or bistable arrangement. This is because the NE-96 has a relatively high differential between fire and sustain voltages even under the widest possible tolerances encountered with respect to lamp characteristic extremes, initially and after aging. Two type NE-96 lamps operating together in a bistable or flip-flop circuit make a highly reliable storage device, but this type of lamp is not as suitable for indicating service as the brighter NE-51. Although paired NE-51 lamps are not reliable storage elements, a circuit storage pair comprising one NE-96 and one NE-51, as used in this control unit circuit, provide both adequate reliability and satisfactory illuminating properties.

The indicator consists therefore of a type NE-51 and a type NE-96 glow lamp connected in parallel through a common resistor R506. Thus only one lamp of the pair can burn at a time since the sustaining voltage across the burning lamp is below the firing voltage of its mate. Once one of the pair is pulsed to become conductive, conduction in the other one extinguishes and this state endures until a counter pulse reverses the order.

Considering the novel answer back circuit in detail,

the two lamps XI501 and I502 are connected to ground through a common resistor R506 (150 K ohms). The other terminal of lamp XI501 is connected through the resistor R505 (2.2 K ohms) to pin 11 of TB501 (a 150 volt. D.C. positive source). The other terminal of lamp I502 is connected to pin 11 of TB501 through a resistor R503 (12 K ohms), resistor R504 (47 K ohms) and resistor R503 forming a voltage divider between pin 11 and ground to control the potential on lamp I502. A 150 volt positive answer back impulse transmitted from the remote receiver back to the sender unit appears on pin 10 of TB501 when a selected function has been completed. This answer back impulse is applied to lamp I502 through the input circuit comprising capacitor C501 (0.1 mfd.) and resistor R507 (68 K ohms). When lamp XI501 is conducting, the receipt of such an answer back impulse is effective to render lamp I502 conductive and extinguish lamp XI501.

With lamp I502 conducting (resulting from the receipt of an answer back signal or the reestablishment of D.C. voltage upon the circuit) the depression of any of keys Start, 1 to 7 and Master Conn or the release of any of those keys from its depressed position will momentarily connect pin 11 to the input circuit of XI501 to apply a 150 volt positive pulse thereto. The input circuit for XI501 consists of capacitor C502 (0.1 mfd.) and resistor R508. The application of such a pulse to this input circuit is effective to render XI501 conductive and extinguish I502.

In operation therefore once the selection of a function has been initiated by the actuation of any of the keys Start, 1 to 7 or Master Conn, I502, the indicator lamp will be extinguished and remain extinguished until an answer back signal is received from the remote receiver indicating the performance by it in the selected function.

In this sender control unit, instead of having a pre-wired disconnect key, disconnection of remote units is effected by cancellation of the disconnect code —1 2— by depression of push button switches 1 and 2. The receipt of an answer back signal in response to transmission of a disconnect code will therefore result in the ignition of indicator lamp I502 rather than the extinction of the indicator lamp as in my aforesaid copending application.

Since, as has been indicated hereinbefore, the first pulse of all of the commonly used code groups is a long pulse, in normal operation, the push button key 1 will be depressed and remain latched.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claim rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claim are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

In a selectively actuated function selecting system in which a sender unit is selectively actuated to transmit a time duration coded signal group indicative of a function to be selected to a remote receiver to effect initiation of the selected function and in which such remote receiver is operative upon successful initiation of the selected function associated therewith to transmit an answer back signal to the sender unit, a coding device for controlling the operation of such a sender comprising a plurality of selectively settable circuit devices each of which is effective to control the character of a distinct unit of the code group, a first means for initiating transmission of a code group under control of said circuit devices, a gas diode bistable circuit device responsive to actuation of said first means and said circuit devices for indicating the initiation of a function selection and re-

sponsive to a receipt of an answer back signal for providing a signal indicative of the successful initiation of the selected function, said bistable circuit device comprising a first neon tube having high differential between its ignition and extinction voltages and a second neon tube having good indicating qualities and a relatively low differential between its ignition and extinction voltages and means interconnecting said tubes to render said tubes operative alternatively.

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