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SELECTIVE SIGNALING SYSTEM

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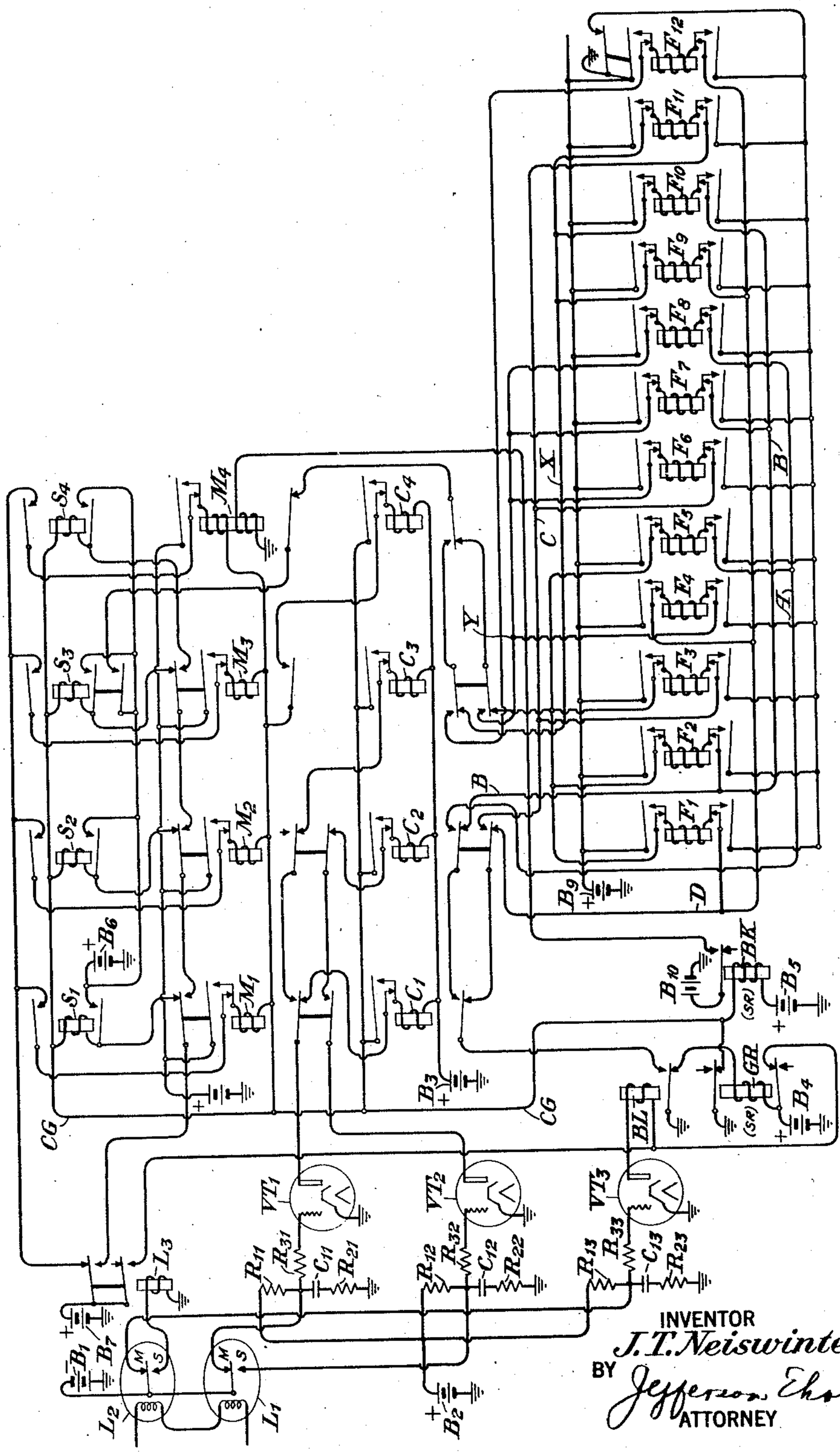

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SELECTIVE SIGNALING SYSTEM

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This invention relates to selective signaling systems and more particularly to such systems in which teletypewriter characters may be used to effect the selective operation.

One of the objects of the invention is to provide a selective signaling circuit employing the codes forming teletypewriter characters for operating any one of a plurality of machines or for switching from one circuit to another.

Another object of the invention is to produce a selective signaling system in which the selective operation is performed by depressing certain of the keys of a keyboard of a teletypewriter system.

Another object of the invention is to provide a selective signaling system using teletypewriter characters in which the selecting operation is accomplished by transmitting a blank signal followed by a code letter and then completed with another blank signal.

It has heretofore been proposed to employ a plurality of sets of relays as a selective system to obtain a number of selections by using dots and dashes similar to the Morse code. The various sets of relays are switched successively into the signaling circuit to record the code transmitted, which consists of either marking or spacing signals. If the code is followed by a long dash, one of the various devices will be selected to the exclusion of all of the other devices.

The difficulty with the system heretofore proposed is that when used in a teletypewriter system it superimposes a Morse signaling system upon a teletypewriter system, the Morse system being used merely for the selective switching operation. According to the present invention the Morse system is completely omitted and in place thereof the code combinations of the characters of the keyboard of the teletypewriter system may be employed in various combinations to perform the desired selective switching operations.

The teletypewriter selective signaling system of this invention is, as already pointed out, an arrangement operated by teletypewriter characters used for the remote control of the machines of various customers, or for the control of cutting circuits, etc. The arrangement comprises, for example, three gas-filled trigger tubes and a number of relays arranged in various groups. With this arrangement a plurality of switching functions may be carried out using but a single character for each selection. In an illustration to be described hereinafter it will be shown that the apparatus may be used for performing, for example, either twelve or twenty or more different functions. False operation by normal teletypewriter signals is effectively prevented by requiring the sending of a blank signal before and after each selecting character. The complete signal for the function selected by the letter "G," for example, would thus be "Blank G blank." No "letters" or "figures" signals are required in any of the various combinations. If desired, a circuit may be arranged so that the second blank signal may be omitted.

This invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing showing one embodiment of this invention merely for the purpose of illustration.

Referring to the drawing, the reference characters F_1 to F_{12} designate twelve of a plurality of relays each of which performs a function such as starting or stopping a teletypewriter machine, or cutting one circuit into a teletypewriter system, or out of the system. There are also a bank of relays designated S_1, S_2, S_3 and S_4, another bank designated M_1, M_2, M_3 and M_4, and a third bank designated C_1, C_2, C_3 and C_4. The drawing also illustrates two relays designated L_1 and L_2, the windings of which are in series with each other and with the teletypewriter circuit that is to be used for the control of the various switching operations. Three gas-filled tubes designated VT_1, VT_2 and VT_3 are also used, each of these tubes being connected to timing circuits to be subsequently described.

When the teletypewriter circuit connected to the windings of relays L_1 and L_2 is used for the transmission of miscellaneous characters during the ordinary operation of the teletypewriter circuit, all of the relays S_1 to S_4 and M_1 to M_4 will be locked up and none of the relays F_1 to F_{12} will be selected. Upon the transmission of a blank signal over the teletypewriter circuit, the relays S_1 to S_4 and M_1 to M_4 will be released by the momentary removal of ground from the windings of these relays, and this will prepare the selector for the receipt of a character for the selecting function. The receipt then of a teletypewriter character arranges the relays C_1 to C_4 in various operated and unoperated conditions to be subsequently described for the selection of only one of the various relays F_1 to F_{12}. A subsequent blank signal will operate the particular F relay selected to complete the switching operation.

The relay C_1 is controlled by the length of the first space in a teletypewriter character, the relay C_1 being operated if the space is two units in length, i. e., 44 ms. for a 60-speed system, the relay C_1 being unoperated if the first space is but one unit in length, i. e., 22 ms. The timing circuit connected to the tube VT_1 will be used to distinguish between the two lengths of spaces. The relay C_2 will be controlled by the length of the first mark in a teletypewriter character, this relay being operated if the first mark is two units in length and unoperated if but one unit in length. The relay C_3 will be controlled by the length of the second space in the teletypewriter

character, the relay C_3 being operated if the second space is two units in length, and unoperated if but one unit in length. The relay C_4 will be controlled by the third mark of the teletypewriter character. Inasmuch as the letters "D," "F," "J," "R," "S," and "Y" are the only teletypewriter characters having six transitions, these letters will be the only ones with a third mark to operate the relay C_4. The operation of the relay C_4 depends only on the presence but not on the length of the third mark.

As an illustration, let us assume that the "I" signal is transmitted. This signal, in which the first and second spaces and the first mark are all two units long, will cause the operation of relays C_1, C_2 and C_3, but as the "I" signal contains no third mark, the relay C_4 will be left unoperated. On the receipt of the "R" signal, for example, the relays C_1 and C_4 will be operated because the first space is two units long, and there is also a third mark. Relays C_2 and C_3 will be left unoperated because the first mark and the second space of the "R" signal are each only one unit long.

When the teletypewriter circuit is in its marking condition, relays L_1 and L_2 will be operated to their marking contacts M. The relay L_1 will then connect negative battery B_1 of, for example, 130 volts to the condenser C_{11} which is connected to ground through a resistance R_{21}. This same voltage will also be applied through a resistance R_{31} to the grid of the tube VT_1. When the teletypewriter circuit is then caused to receive a spacing signal, the relays L_1 and L_2 will be released to their spacing contacts S, and this will remove the negative voltage of battery B_1 from the condenser C_{11}. The removal of the negative voltage of battery B_1 will leave the positive voltage of battery B_2 connected to the condenser C_{11} through a high resistance R_{11}. Thus soon after the armature of relay L_1 leaves its marking contact M the charge on the condenser C_{11} will start to change from that of the negative battery B_1 toward the final value of the positive battery B_2, which may also be of 130 volts. When the charge on the condenser C_{11} and, therefore, on the grid of the tube VT_1 reaches some intermediate value as, for example, —15 volts, the tube VT_1 will become ionized and current will flow through its anode circuit which includes the battery B_3, the winding of relay C_1, the make-before-break contact of relay C_1, the lower inner armature of relay M_1 and its back contact, and the anode and grounded cathode of tube VT_1.

The value of the capacity of condenser C_{11} and of the resistances just described which are associated therewith have been chosen so as to cause the tube VT_1 to ionize in, for example, 33 ms. after the relay L_1 has removed the battery B_1 from the circuit of condenser C_{11}. This interval of time is midway between the length of a single impulse and that of two impulses, but it will be understood that this time interval need not be midway between the lengths of the two types of impulses. Thus if an impulse of but one unit is sent, the tube VT_1 will not become ionized, and the relay C_1 will not become operated, while, on the other hand, if the received spacing impulse is two units long, the tube VT_1 will become ionized and the relay C_1 will then be operated.

The tube VT_2 operates in the same manner as the tube VT_1, except that this tube remains unionized when the voltage of battery B_1 is applied to the condenser C_{12} and to its control grid through the resistor R_{32} during the spacing condition of the teletypewriter circuit. The tube VT_2 will become ionized only when marking signals are received which are two or more units long. Likewise the tube VT_3 operates in a similar manner, this tube becoming ionized on spacing signals. The condenser C_{13} and its associated resistors are of such values that the tube VT_3 will become ionized only on receipt of spacing signals which are, for example, 121 ms. long or more. It will happen, therefore, that the blank signal will be the only teletypewriter character to cause the ionization of the tube VT_3.

It may be said in general that the relays S_1, S_2, S_3 and S_4 operate on the first, second, third and fourth spaces, respectively, received on the teletypewriter circuit after the selector has been cleared by the blank signal. The relays M_1, M_2, M_3 and M_4 operate on the first, second, third and fourth marks, respectively, received on the teletypewriter circuit after the selector has been cleared and the circuit closed again by the blank signal. The relay C_1 operates if the first space is two or more units long, the relay C_2 operates if the first mark after the first space is two or more units long, the relay C_3 operates if the second space is two or more units long, and the relay C_4 operates only if there is a third mark regardless of its length after the receipt of the first space. The F relays perform a function such as starting any one of a plurality of machines (not shown) or they perform some other switching function. An F relay is first selected by the proper arrangement of the armatures of the C relays, and the selected F relay is operated by the second blank signal. An additional armature (not shown) may be provided for each F relay to control a corresponding external circuit (not shown).

If a marking signal is transmitted over the teletypewriter circuit, the relays L_1 and L_2 will be operated and their armatures will close their contacts designated M. The relay L_3, the winding of which is connected to the contact S of the relay L_2 will be unoperated. The relay BL, which is connected to the anode circuit of the tube VT_3, will also be unoperated due to the fact that the tube VT_3 is deionized. The relay GR will, however, be operated, current for which is supplied by battery B_4 over a circuit which includes the winding of relay GR and the armature and back contact of relay BL and ground. The operation of relay GR will in turn cause the operation of relay BK, current flowing from battery B_5 over the circuit of the winding of relay BK and the upper armature and contact of the relay GR and ground. The relays S_1 to S_4 and M_1 to M_4 may be in an operated condition, as would be the case if miscellaneous signals had previously been sent over the teletypewriter circuit.

Upon the receipt of a blank signal over the teletypewriter circuit, relays L_1 and L_2 will release, their armatures then closing their S contacts. The voltage of battery B_1 will then be removed from condenser C_{13} which is associated with tube VT_3, the circuit to the condenser C_{13} being opened at the contact M of relay L_2. As the usual duration of a blank signal is about 132 ms., then after about 121 ms. the charge on the condenser C_{13} will be reduced from that of battery B_1 to a much lower value as, for example, —15 volts, and hence tube VT_3 will become ionized. This will cause the relay BL to become operated, current flowing from battery B_4 over a circuit which includes the lower armature and front contact of relay GR, the winding of relay

BL, the anode and cathode of tube VT_3 and ground. The operation of relay BL will place a ground on the circuit leading to the lower armature of relay C_1, and thus to the windings of some of the relays F_1 to F_{12} that may have been selected by the lower armatures of the relays C_1 to C_4 that may have been set up by the teletypewriter pulses. None of the relays F_1 to F_{12} will be operated by this action, however, for the reason that current cannot flow through any of the windings of the relays F_1 to F_{12} due to the disconnection of the battery B_6 from these windings. The battery B_6 may be connected to the lower armature of relay M_4 through the lowermost armature and make contact of relay S_3, but the relay M_4 being operated, will open the circuit of battery B_6 at the lower armature and contact of relay M_4. The operation of relay BL causes relay GR to release due to the opening of the circuit at the back contact of relay BL. Relay GR is of the slow-release type and requires a predetermined time interval, such as 5 or 6 ms., to elapse before it becomes fully released. The release of relay GR removes a common ground CG from the windings of relays S_1 to S_4, M_1 to M_4 and C_1 to C_4, the common ground conductor CG being connected to the windings of relays C_1 to C_4 through their upper armatures and their respective make contacts. By removing the common ground CG from all of these relays they will all release.

The release of the relay GR also removes the positive voltage of battery B_4 from the anode of the tube VT_3, the circuit interruption occurring at the lower armature and make contact of relay GR. Although the teletypewriter circuit is still in a spacing condition, the removal of the positive voltage of battery B_4 from the anode circuit of tube VT_3 will have no effect for the reason that the relay L_3 will still supply positive voltage to the anode circuit of tube VT_3 from the battery B_7, the battery B_7 being connected to the anode circuit of the tube VT_3 over the lower armature and back contact of relay L_3 and the winding of relay BL.

Should the teletypewriter circuit now become closed, the relays L_1 and L_2 will be operated and their armatures will close their contacts designated M. The relay L_3 will then release. The relay L_2 will then connect the negative voltage of battery B_1 to the condenser C_{13}, and the release of relay L_3 will disconnect battery B_7 from the anode circuit of tube VT_3, the circuit being opened at the lower armature and contact of relay L_3. The tube VT_3 will then deionize and relay BL will then release. The release of relay BL will reoperate the relay GR.

Although the relay BK is of the slow-release type, the blank signal is not of long enough duration to allow relay BK to release, and hence relay BK remains operated. Thus it will be seen that the receipt of a blank signal will release relay GR and open the common ground circuit of conductor CG so that all of the relays S_1 to S_4, M_1 to M_4 and C_1 to C_4 will become released (though all of these relays may not have been previously operated), and then to reoperate the relay GR so as to reconnect ground to the conductor CG for the subsequent operation of the relays S_1 to S_4, M_1 to M_4 and C_1 to C_4.

The first spacing signal of the teletypewriter character following the blank signal will release relays L_1 and L_2, moving their armatures to their S contacts, and at the same time operate relay L_3. The receipt of this spacing signal will cause the relay S_1 to operate, current flowing from battery B_7 over the circuit of the upper armature and make contact of relay L_3, the uppermost armature and back contact of relay M_1, the winding of relay S_1 and the common ground CG, which is connected to ground through the upper armature and make contact of relay GR. If this spacing signal is two or more units in length, the tube VT_1 will become ionized and operate relay C_1, current flowing from battery B_3 over the winding of relay C_1, the make-before-break contact of relay C_1, the lower inner armature and back contact of relay M_1 and the anode circuit of tube VT_1, the cathode of which is grounded. The operation of relay C_1 will break the anode circuit of tube VT_1 due to the opening of the make-before-break contact of relay C_1. The tube VT_1 will then become deionized and the charge on condenser C_{11} will then be returned to the negative potential of battery B_1 at the completion of the space of the character. The operation of relay S_1 prepares the circuit for the operation of relay M_1 on the mark following the first space of the teletypewriter character, as will now be explained.

The receipt of the first mark after the first space of the teletypewriter character will return the armatures of relays L_1 and L_2 to their M contacts and release relay L_3. Relay M_1 will then become operated, current flowing from battery B_7 over the upper armature and back contact of relay L_3, the upper armature and make contact of relay S_1, the make-before-break contact of relay M_1, the winding of relay M_1 and the grounded conductor CG. The operation of relay M_1 will, through its uppermost armature and make contact, prepare the circuit for the operation of relay S_2 on the second space of the character, the circuit to relay S_2 being completed through the uppermost armature and back contact of relay M_2. The operation of relay M_1, by means of the attraction of its lowermost armature, prepares a circuit for the operation of relay C_2. The circuit to the winding of relay C_2 includes the lowermost armature and make contact of relay M_1, the lowermost armature and back contact of relay M_2 and the make-before-break contact of relay C_2. Upon the ionization of tube VT_2, relay C_2 will become operated if the subsequent mark is two units or more in length, as already pointed out. The lower inner armature of relay M_1 will, upon the operation of relay M_1, prepare the circuit for the operation of the relay C_3 by the second space of the character, the connection to the winding of relay C_3 being completed from the anode circuit of tube VT_1, the lower inner armature and make contact of relay M_1, the lower inner armature and back contact of relay M_2 and the make-before-break contact of relay C_3, which extends to the winding of relay C_3, the other end of the latter winding being connected to the battery B_3.

If the next mark is of but one unit in length, the tube VT_2 will remain deionized. If the subsequent mark is two units in length, the tube VT_2 will be ionized, and hence relay C_2 will be operated upon completion of the circuit just traced. At the conclusion of the latter mark the space in the character which follows it, which is, of course, the second space of the character, will operate the relay S_2, current for which is supplied by battery B_7 over the upper armature and make contact of relay L_3, the uppermost armature and make contact of relay M_1, the uppermost armature and back contact of relay M_2,

the winding of relay S_2 and the common ground CG. The operation of relay S_2 prepares a circuit for the operation of relay M_2 on the following mark of the character, the circuit to the winding of relay M_2 being completed to the make-before-break contact of relay M_2 and the upper armature and make contact of relay S_2. If the second space is two units or more in length, the relay C_3 will be operated. The circuit through the winding of relay C_3 includes the battery B_3, the winding of relay C_3, the make-before-break contact of relay C_3, the lower inner armature and back contact of relay M_2, the lower inner armature and make contact of relay M_1, and the anode circuit of tube VT_1. The mark following the second space of the character, which is the second mark of character, will operate the relay M_2, current flowing from battery B_7, over the upper armature and back contact of relay L_3, the upper armature and make contact of relay S_2, the make-before-break contact of relay M_2, the winding of relay M_2, and the common ground CG. The operation of relay M_2 breaks the anode circuits of tubes VT_1 and VT_2, the circuit of tube VT_1 being broken at the lower inner armature and back contact of relay M_2, and the circuit of tube VT_2 being broken at the lowermost armature and back contact of relay M_2. But the operation of relay M_2 prepares a circuit for the operation of relay S_3 on the third space of the character, or if the character has but two spaces (i. e., if it is a four-transition character), the relay S_3 will be operated on the first space of the following character, the circuit to the winding of relay S_3 extending through the uppermost armature and back contact of relay M_3, the uppermost armature and make contact of relay M_2, the uppermost armature and make contact of relay M_1, and the upper armature and make contact of relay L_3, which is connected to battery B_7.

Let us assume that the character transmitted over the teletypewriter circuit is to set up a selection on the relays C_1 to C_4 from a four-transition character. There are, of course, eight letters, i. e., X, G, Q, B, P, W, L or I which are of the four-transition type. Inasmuch as a four-transition character has only two marks after the first space, the completion of this character will leave the selecting circuit with relays S_1, M_1, S_2 and M_2 operated, and the path prepared by relay M_2 will prepare the circuit for the operation of relay S_3. The four-transition character will also leave the relay C_4 unoperated, because there is no third mark in the character. There will thus be one of eight possible combinations selected through relays C_1, C_2 and C_3 of the system.

In order to operate one of the relays F_1 to F_{12} selected by the combination set up on the relays C_1 to C_4, a blank signal must be sent after the selecting character is transmitted. The space of the blank signal will operate the relay S_3, the battery B_7 supplying current over the upper armature and make contact of relay L_3, the upper outer armatures of relays M_1 and M_2 and their respective make contacts, the upper outer armature and back contact of relay M_3, the winding of relay S_3 and the common ground CG. The operation of relay S_3 prepares for the possible operation of relay M_3, the circuit for which includes battery B_7, the upper armature and back contact of relay L_3, the upper armature and make contact of relay S_3, the make-before-break contact and winding of relay M_3 and the common ground CG. The operation of relay S_3 also connects battery B_6 to the lowermost armature of relay C_3 and the lower armature of relay C_4, the interconnecting circuit including the lowermost armature and make contact of relay S_3 and the lower armature and back contact of relay M_4 and extending to the two armatures of the C relays just referred to. The battery B_6 will, therefore, be able to supply current to the windings of certain of the F relays which have been selected for operation. It will be observed, for example, that the lowermost armature of relay C_3 is connected through its back contact and through the make-before-break contact to the winding of relay F_1, but the operation of relay S_3 will not in itself operate the relay F_1, for example, because ground has not yet been supplied to the other side of the relay winding.

The space of the second blank signal will ionize the tube VT_3 and hence cause the relay BL to operate, current flowing from battery B_4 over the lower armature and make contact of relay GR, through the winding of relay BL to the anode circuit of tube VT_3. The operation of relay BL then places ground on the lower armature of relay C_1 and on one of the two lower armatures of relay C_2. If the relays C_1 and C_2 are in their released conditions, as shown in the drawing, ground will be connected through the armature and make contact of relay BL, through the lower armature and back contact of relay C_1, and the lowermost armature and back contact of relay C_2 to the winding of relay F_1 through its lower make-before-break contact. But it will be shown hereinafter that by various operations of the relays C_1 to C_4 any one of the various relays F_1 to F_{12} may be operated.

When any one of the F relays, such as F_1, becomes operated, it will be locked up in its operated condition by the flow of current from battery B_9 over a circuit which includes the upper armature and make contact of relay F_1, the winding of relay F_1, the lower armature and make contact of relay F_1, and the uppermost armature of relay F_{12} and its back contact, the latter armature being grounded. The relay F_1 will remain locked up only until the relay F_{12} is selected and operated. Thus when relay F_{12} is operated, the ground connected to the lower armature of relay F_1 (which is also connected to the other lower armatures of relays F_2 to F_{12}) will be disconnected from the armatures, and the locking circuit will, therefore, be removed. It will be apparent that the battery B_9 supplies current for locking any one of the other relays F_2 to F_{12}.

It has been shown that when relays C_1 to C_4 are all unoperated, the relay F_1 will be selected and become operated after the receipt of the second blank signal. The conditions required to operate relay F_1, as well as the other F relays, are given in the following table:

C_1	C_2	C_3	C_4	Letter and code	Relay
0	0	0	0	X SMSMMM	F_1
1	0	0	0	G SSMSMM	F_2
0	1	0	0	Q SMMMSM	F_3
0	0	1	0	B SMSSMM	F_4
1	1	0	0	P SSMMSM	F_5
0	1	1	0	W SMMSSM	F_6
1	0	1	0	L SSMSSM	F_7
1	1	1	0	I SSMMSS	F_8
0	0	0	1	Y SMSMSM	F_9
1	0	0	1	R SSMSMS	F_{10}
0	1	0	1	J SMMSMS	F_{11}
0	0	1	1	D SMSSMS	F_{12}

From this table it will be observed that when relay C_1 is operated and relays C_2, C_3 and C_4

are unoperated, which occurs when the letter "G" is transmitted over the teletypewriter circuit after the blank signal is transmitted, the relay F_2 will be selected. When the letter "I" is likewise transmitted, relays C_1, C_2 and C_3 will be operated, relay C_4 remaining unoperated, and in this case relay F_8 will be selected.

A predetermined interval of time after relay BL operates and causes the selection of one of the F relays, the relay GR releases, thereby removing ground from the common ground wire CG. This then releases all of the relays S_1 to S_4, M_1 to M_4 and C_1 to C_4. Under the conditions above described in which the third mark of the character has not been received, the relay M_3 will remain unoperated.

When a six-transition character is sent into the selecting circuit after the first blank signal has been received, the first two spaces will operate the relays S_1 and S_2, and the first two marks will operate the relays M_1 and M_2, as previously described, and establish a combination on relays C_1, C_2 and C_3. The third space of the character will operate relay S_3 and relay S_3 will prepare the path for the operation of relay M_3 on the subsequent mark. The relay S_3 will also connect the battery B_6 to the lower armature of relay C_4 and to one of the lower armatures of relay C_3, the interconnecting circuit including the lowermost armature and make contact of relay S_3 and the lower armature and back contact of relay M_4.

The third mark will operate relay M_3. Relay M_3 will cause the operation of relay C_4. Relay C_4 is thus operated only by a six-transition character code combination which includes a third mark. But relay C_4 will be unoperated by any four-transition character code combination for the reason that any such combination does not include a third mark. The operation of relay C_4, of course, leads to a different selection of the F relays than would be the case if only a four-transition character code combination is received. The blank signal following the six-transition character will then operate the F relay selected, because relay BL will be operated to apply ground to the selected F relay. The blank signal will clear out the selector by releasing all of the S, M and C relays, as already pointed out.

If instead of a blank signal another character is sent after a selecting character, then relay M_4 will become operated, and this in turn will open the battery circuit to the lower armatures of the relays C_3 and C_4, the circuit being opened at the lower armature and contact of relay M_4. Thus when relay M_4 becomes operated no F relay can be operated until a blank signal is sent to clear the selector again, this blank signal then being followed by a selecting character and a second blank signal. The relay M_4 insures the operation of one of the F relays only when two blank signals are sent, the two blank signals being separated by one of the predetermined teletypewriter characters used for the switching operations.

If the teletypewriter character is one embodying but two transitions, then only relays S_1 and M_1 will be operated. A blank signal following this two-transition character will then operate relay S_2, but none of the relays F_1 to F_{12} will be operated because, the relay S_3 being released, battery B_6 will be unable to supply current to any one of the F relays.

The relay BK is employed to prevent "breaks" on the circuit from performing the same operations as are intended by the blank signal. If a break signal of, for example, 150 ms. occurs, relay BL will be operated and thereby release relays GR and BK. The release of relay BK operates relay M_4, current being supplied by battery B_{10} to the lower winding of relay M_4, and through the armature and back contact of relay BK. Thus the relay M_4 will be operated regardless of whether relay GR has removed ground from the conductor CG, which extends to the other winding of relay M_4. Thus the completion of a break signal leaves relay M_4 operated, but none of the F relays can be operated due to the opening of the battery circuit at the lower armature and back contact of relay M_4. As already pointed out, an F relay can be operated only upon the completion of a blank signal followed by a character and this followed by a second blank signal. If a desired selection on the C relays has been established and relay M_4 is unoperated, then a break signal on the circuit will operate the F relay selected by the C relays. This circuit can be arranged, however, so as to prevent the operation of the F relay due to the receipt of a break signal after an F relay has been selected. This can be accomplished by substituting for battery B_9 the battery B_{10} connected through the make contact of relay BK.

When the second blank signal is received, it will release whatever S, M and C relays have previously been operated. This blank signal will operate the F relay, such as F_8, previously selected. The operated F relay, i. e., F_8, may be released only by operating relay F_{12} by transmitting "blank B blank." Relay F_{12} momentarily removes ground from the winding of relay F_8, causing relay F_8 to release. The operation of relay F_{12} will also remove ground from the winding of relay F_{12} and hence relay F_{12} will also release.

The circuit shown in the drawing has been set up to provide twelve possible combinations, i. e., twelve relays F_1 to F_{12}. This arrangement may be modified, as will be apparent to those skilled in the art, to provide, for example, twenty or more combinations. For twenty combinations a fourth vacuum tube circuit similar to those already described will be added which may be operated on spaces which are four units in length. The rest of the circuit will require some additions and modifications as need not be described.

The selecting circuit of this invention consists only of gas tubes and flat type relays. It would, therefore, have numerous advantages over mechanical distributors and the like which may be used for selecting or switching operations. The initial cost, as well as the maintenance cost, of a scheme such as that described herein will be comparatively small.

The tubes VT_1—VT_3 and any other tubes that may be added may be of any gaseous type as, for example, of the 885 type well known in the art. The various positive batteries, such as B_2 to B_6 for example, may be one and the same battery. The voltage, electrical and time constants recited hereinabove have been given merely for the purpose of illustration and explanation, and are not to be construed as limitations upon the invention.

While this invention has been shown and described in certain particular embodiments merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a signaling system, the combination of a signaling circuit over which teletypewriter coded characters may be sent, first and second sets of relays, means responsive to a teletypewriter blank signal transmitted over said signaling circuit to release all of the relays of said first and second sets, means responsive to a predetermined teletypewriter character transmitted over said signaling circuit following said blank signal to operate predetermined relays of the first set and prepare for the operation of but one of the relays of the second set, and means responsive to a second teletypewriter blank signal following said predetermined teletypewriter character to operate the prepared relay of the second set.

2. In a signaling system, the combination of a signaling circuit over which teletypewriter characters may be transmitted, a set of relays, means responsive to a teletypewriter blank signal transmitted over said signaling circuit to release all of said relays, a plurality of circuits controlled by said set of relays, means responsive to a predetermined teletypewriter character following said blank signal transmitted over said signaling circuit to operate selected relays corresponding to the teletypewriter character transmitted and prepare for the operation of but one of the circuits controlled by said relays, and means responsive to a second teletypewriter blank signal following said predetermined character signal transmitted over said signaling circuit to operate the circuit prepared by said relays.

3. In a signaling system, the combination of a signaling circuit over which teletypewriter characters may be transmitted, a plurality of relays, a plurality of circuits, said circuits being controlled by said relays, means responsive to a teletypewriter blank signal transmitted over the signaling circuit to release all of said relays, means responsive to a predetermined teletypewriter signal following said blank signal transmitted over said signaling circuit to selectively operate a number of said relays corresponding to said predetermined signal and prepare for the operation of but one of said circuits, and means responsive to a second teletypewriter blank signal following said predetermined teletypewriter signal transmitted over said signaling circuit to operate the circuit prepared by said relays.

4. In a signaling system, the combination of a signaling circuit over which teletypwriter characters may be transmitted, a plurality of relays, means responsive to a first predetermined teletypewriter character transmitted over said signaling circuit to release all of said relays, means responsive to a second teletypewriter character following said first character transmitted over said signaling circuit to selectively operate certain of said relays corresponding to said second character, a plurality of switching circuits which are controlled by said relays, means whereby one of said switching circuits is prepared by said relays to the exclusion of all other switching circuits, and means responsive to the repetition of the first teletypewriter character to operate the switching circuit prepared by said relays.

5. In a signaling system, the combination of a teletypewriter circuit over which teletypewriter characters may be transmitted, first, second and third sets of relays, means responsive to a blank signal transmitted over said teletypewriter circuit to release all of the relays of the first, second and third sets, means for sequentially operating relays of the first set in accordance with the successive spacing pulses following the blank signal transmitted over the teletypewriter circuit, means for sequentially operating the different relays of the second set by the successive marking pulses following the blank signal transmitted over the teletypewriter circuit, means whereby the relays of the third set are controlled by the relays of the first and second sets, a plurality of switching circuits controlled by the relays of the third set, means whereby one of the switching circuits is prepared for operation by the relays of the third set to the exclusion of all other switching circuits, and means responsive to a second blank signal transmitted over the teletypewriter circuit for operating the circuit controlled by the third set of relays.

6. In a signaling system, the combination of a signaling circuit over which teletypewriter characters may be transmitted, first, second and third sets of relays, a plurality of timing circuits, means responsive to a blank signal transmitted over the signaling circuit to release all of said relays, means for sequentially operating the relays of the first set in accordance with the number of spacing pulses following the blank signal transmitted over the signaling circuit, means for sequentially operating the relays of the second set in accordance with the number of marking pulses following the blank signal transmitted over the signaling circuit, the relays of the third set being connected to said timing circuits, a plurality of switching circuits controlled by the relays of the third set, means whereby only one of said switching circuits is selected by the relays of the third set to the exclusion of all other switching circuits, means including said timing circuits for operating the relays of the third set in accordance with the durations of the pulses transmitted over the signaling circuit following the blank signal and for preparing the selected switching circuit for operation, and means responsive to a second blank signal to operate the switching circuit prepared by the third set of relays.

7. In a signaling system, the combination of a signaling circuit over which teletypewriter characters may be transmitted, first, second, third and fourth sets of relays, means responsive to a blank signal transmitted over the signaling circuit for releasing all of said relays of the first, second and third sets, a plurality of timing circuits responding to the pulses transmitted over the signaling circuit, a plurality of gas-filled tube circuits each of which is connected to one of said timing circuits, means responsive to the operations of the first and second sets of relays and the ionization of said gas-filled tube circuits for operating certain selected relays of the third set and thereby preparing for the operation of but one of the relays of the fourth set, means for sequentially operating the relays of the first set in accordance with the consecutive spacing pulses following the blank signal transmitted over the signaling circuit, means for sequentially operating the relays of the second set in accordance with the consecutive marking pulses following the first blank signal transmitted over the signaling circuit, and means responsive to the second blank signal transmitted over the signaling circuit for operating the relay of the fourth set selectively prepared by the relays of the third set.

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