

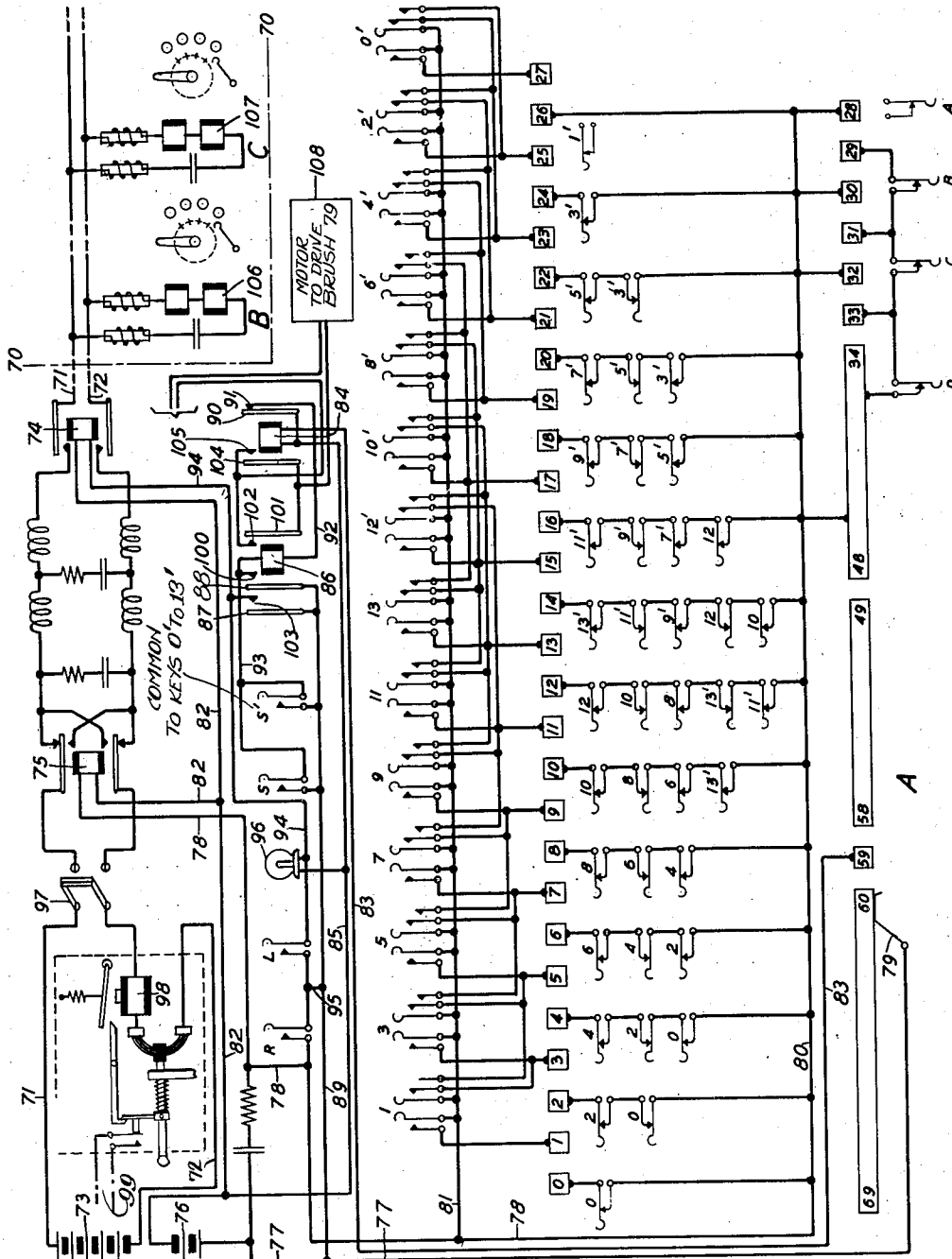
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ELECTRICAL COMMUNICATION SYSTEM

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ELECTRICAL COMMUNICATION SYSTEM

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This invention relates to electrical communication systems comprising a central station and a plurality of substations and more particularly to signaling means in such a system for signaling the various substations from the central office.

The object of this invention is to provide an impulse sender which is simple in construction and which will invariably transmit impulses of uniform duration even after long usage.

Features of this invention reside in a selector key system at the central station in which connections may be set up on a suitable set of keys representing numbers in a code and in which, in order to initiate a call, it is only necessary to operate keys representing the first and last numbers of the code.

Other features including the employment in the selector key system of a constant speed motor to drive certain operating parts so that the signaling impulses will be of uniform duration will be apparent from a study of the specification and reference to the accompanying drawing.

This invention while not necessarily limited to such use has been found particularly well adapted for use in a train dispatching system wherein a plurality of substations are selectively signalled from a train dispatcher's office.

The application of this invention to a train dispatching system is shown in the accompanying drawing which is a schematic of such a system including only such portions as are pertinent to this invention and in which A represents the train dispatcher's station and B and C substations along the line. The apparatus to the left of as well as that which is below the broken line 70—70 is located at the central or train dispatcher's office and the apparatus to the right and above the broken line 70—70 is located at the substations of the system.

Connecting the train dispatcher's office A with the substations B and C, are the line wires 71 and 72 over which are sent codes of impulses, in which each succeeding impulse is of opposite polarity to the one preceding it, to operate the selectors 106 and 107 located at the substations B and C, respectively, and which may be step-by-step selectors of the type such as described in Patent No. 1,343,256, issued June 15, 1920, and of which it is unnecessary to show and describe a complete structure here. These selectors, however, operate upon each impulse of opposite polarity to the one preceding it to step a movable contact member one step toward a contact making position. When impulses corresponding in number and sequence to the setting of a particular se-

lector have been received, that selector will operate to cause the sounding or displaying of a suitable signal at that particular substation.

To furnish current to the line wires 71 and 72, the main line battery 73 is shown bridged across the line at the central station. This main line battery, however, may be replaced by any suitable current producing medium such as a motor generator, or energy may be supplied to the line from a commercial supply line of alternating current through a suitable rectifier such as described in Patent No. 1,543,836, June 30, 1925.

To connect the central or train dispatcher's circuit to the line wires 71 and 72, a line relay 74 is shown which, as will be later explained, is operated upon the initiation of a call.

To reverse the polarity of the current traversing the line wires 71 and 72 and cause the impulses necessary for the operation of the selectors 106 and 107 at the substations B and C respectively, a pole changer relay 75 is shown at the central or train dispatcher's station A. This pole changer relay 75 receives current from a local battery 76 through the conductors 77 and 78 by way of the contacts in the selector key as will be later explained.

The selector key shown as located at the central or train dispatcher's office A, and in which call connections represented by a system of numbers and letters may be set up on suitable keys, comprises a set of fixed contacts in this instance shown as a set of segments numbered 0 to 69 inclusive, and a wiper arm or brush 79 having a sufficiently wide contact surface to bridge the gap between successive segments and traveling over and making contact with each segment in regular succession. The brush 79 is electrically connected to the lower terminal of the local battery 76 by conductor 77 and is driven by a motor 108. The motor 108 shown on the drawing as motor to drive the brush 79 is a substantially constant speed motor energized from some reliable source of current and rotates the brush 79 over the segments at a uniform speed so that the dwelling time of the brush on each of the segments will be the same and the impulses sent over the line to operate the selectors will be of uniform duration. Certain of the segments are connected by suitable leads to the upper terminal of the local battery 76.

The segments 0 to 27 inclusive with the exception of segment 26 are wired to keys which are arranged in groups representing the first and the last selective positions of the selectors 106 and 107. For each of these segments there is a

key and each segment through its associated key has a means of connection to two other segments. There is, for example, a key 0 for the segment 0 corresponding to the key 1 for segment 1 and on this key 0 are three contacts, one connected to the segment 0, another to the segment 2 and another to the segment 4. The segments 0 to 27 inclusive with the exception of segment 26 may, through their corresponding keys, be electrically connected or disconnected with respect to the terminal of the local battery 76 opposite to the terminal to which the brush 79 is connected. Segment 26 is permanently connected to bus bar 80. Key 1' which is the corresponding key to this segment is not electrically connected to any part of the system. This key is used as a restoring key for other keys in the second group. All of the keys are locking keys and each key as it is depressed causes the release of any other key in the group which happens to be depressed.

Alternate segments from 0 to 24 inclusive are normally connected through their corresponding keys with bus bar 80. Segment 28 like segment 26 is permanently connected to the bus bar 80. Alternate segments from 1 to 27 inclusive may be connected through their corresponding keys with bus bar 81. Bus bars 80 and 81 are, through conductor 73, winding of pole changer relay 75, and conductor 82, connected to the terminal of the local battery 76 opposite to that to which the brush 79 is connected.

Each alternate segment from 1 to 13 inclusive may, through its corresponding key, be connected with the next two alternate succeeding segments. Each alternate segment from 15 to 27 inclusive may through its corresponding key be connected with the next two alternate preceding segments.

Each alternate segment from 0 to 12 inclusive is normally connected through its corresponding key with the next two alternate succeeding segments.

Each alternate segment from 14 to 24 inclusive is normally connected through its corresponding key with the next two alternate preceding segments.

Segments 29, 31 and 33 are normally connected in series through locking keys B, C and D respectively to segments 34 to 48 inclusive which although shown as a continuous bar are in reality segments permanently connected in series and to the bus bar 80 and by way of conductor 78, winding of pole changer relay 75, and conductor 82 to one side of the local battery 76.

Segments 49 to 58 inclusive which are shown as a continuous bar but which are in reality separate segments (not connected) are not in circuit connection with the local battery 76.

Segment 59 is connected through conductor 83, winding of relay 84, conductor 85 to one terminal of the local battery 76.

Segments 60 to 69 inclusive which although shown as a continuous bar are in reality separate segments and like segments 49 to 58 inclusive above mentioned, have no circuit connection with the local battery 76.

Keys 0 to 13 inclusive are locking keys and are arranged on a suitable key board as a first group and represent the first selective movement to be given the selectors 106 and 107 of the substations B and C. Keys 0' to 13' inclusive are locking keys and are arranged on the key board as a second group and represent the last selective movement to be given the selectors 106 and 107. The keys A, B, C, D, R, L and S are arranged on the key board as a third group. Keys A, B,

C and D are locking keys and correspond to different signaling contacts on the selectors 106 and 107. Key A is for normal position and B, C, and D are advanced positions and provide for the sending of additional impulses to step the movable contact members of the selectors around to the required additional positions. Key A is not electrically connected to any part of the system but is employed to release any other key in the same group, namely, keys B, C and D which happens to be depressed.

Keys R, L and S are non-locking keys. Key R is for operating the pole changer relay 75 and cutting out the selector key proper in case of error. Key L is for operating the line relay 74 and serves in conjunction with the key R to continue the sounding or displaying of the signal at a substation for longer than the normal period. Key S is for making a repeat call, while the call connection is set up on the keys, without having to release and make a new set-up.

S' is a common contact for all of the keys in the second group and operates momentarily upon operation of any one of these keys to complete the circuit of the locking relay 86.

Keys R, L and S and common contact S' and the armatures 87 and 88 of locking relay 86 are connected by conductor 89 to the lower side of the local battery 76 over conductor 77. The other side of the local battery 76 is extended over conductor 85 through armature 90 of relay 84, normally closed contact 91, conductor 92, winding of locking relay 86, conductor 93, to complete the circuit to the key S and common contact S'.

Line relay 74 is connected to the upper side of the local battery 76 by means of conductor 82 and may be brought into connection with the other side of the battery by means of key L through conductor 94, conductors 95, 89 and 77, respectively.

A lamp 96 bridged across the conductors 94 and 85 serves as a signal to indicate the connecting in of the train dispatcher's apparatus to the line and the operation of the selector key driving motor 108.

A double-pole single-throw switch 97 has been shown as a means for connecting the main battery 73 to the line and a circuit breaker 98 has been provided to break the line circuit and close an alarm circuit 99 when an excessive amount of current flows on the line.

To set forth the comparatively simple manual operations required in the initiation of a call, and the automatic operation of the apparatus in bringing about its establishment, it will now be assumed that it is desired to communicate with a substation on the line having assigned thereto the code number 8—5—4, and having its selector set to cause the displaying or sounding of a signal when three successive trains of impulses corresponding in number and sequence to the code number of the substation have been sent over the line.

To set up the desired call connection, it will only be necessary to set up on the selector key board the first and the last of the code numbers to be called which in this case will be 8, in the first group of keys and 4' in the second.

Upon depression of the key 4' in the second group, the common contact S' will close which will bring into operation the locking relay 86 over the circuit as follows: Lower terminal of local battery 76, conductor 77, conductor 89, common contact S', conductor 93, winding of relay 86, conductor 92, normally closed contact 91, armature 150

90 of relay 84, conductor 85 to the other pole of the local battery 76. Relay 86 will pull up armature 88 against contact 100, lock up and close the circuit of the motor 108 through the pulling up of armature 101 against the contact 102. Relay 86 will also close the circuit of the line relay 74 by pulling up armature 87 and closing the circuit as follows: Local battery 76, conductor 77, conductor 89, armature 87, contact 103, conductor 94, upward to winding of line relay 74, conductor 82, to local battery 76.

The line relay 74 has now been operated to connect the train dispatcher's apparatus to the line and the motor 108 which may be energized from any suitable service line, has begun to drive the brush 79 of the selector key over the selector key segments. The brush 79 is normally resting, as shown in the drawing, on segment 60 or possibly 61 or 62 and must travel over all the succeeding segments from this point to segment 0 before another pulse succeeding the one sent by the operation of line relay 74 reaches the selectors B and C. Should the pulse, therefore, which has been transmitted to the line by the initial operation of line relay 74 be sufficient to cause movements of the movable contact members of the selectors, the movable contact members will have time to restore to normal before the code signal is started.

Upon the brush 79 reaching segment 0, which is normally connected to bus bar 80, the circuit of the pole changer relay 75 will be closed as follows: Upper terminal of local battery 76, conductor 82, winding of relay 75, conductor 78, bus bar 80, segment 0, brush 79, conductor 77 to lower terminal of local battery 76. The pole changer relay 75 will operate to produce the effect of reversing the battery connections on the line and will send an impulse over the line to step the movable contact members of the selectors 106 and 107 at the substations, one step toward signaling position. The brush 79 then passes from segment 0 to segment 1 whereupon this segment, not being connected through its corresponding key contacts with bus bar 81, the circuit of the pole changer relay 75 is broken. Pole changer relay 75 thereupon releases its armatures and allows them to return to normal position which results in a change of poles again and causes the sending of another impulse over the line to operate the selectors 106 and 107 to advance their movable contact members another step toward signaling position. Reversal of the poles continues until eight impulses have been sent over the line and brush 79 reaches segment 8.

Key 8 having been depressed and as its three contacts disconnect segments 8, 10 and 12 from connection with bus bar 80, there is no further operation of the pole changer relay 75 until segment 14 is reached whereupon the pole changer relay 75 is brought into operation again to send five impulses over the line while the brush is passing over segments 14 to 18 inclusive which moves the selectors 106 and 107 five steps corresponding with the second selected position in the code.

Key 4' having been depressed, its three contacts connect segments 19, 21 and 23. When the brush 79 reaches segment 19, pole changer relay 75 ceases to operate and does not operate again until the brush 79 reaches segment 25. Whereupon it operates again and sends four impulses over the line to advance the selectors four steps, corresponding to the third selected position.

Upon the sending of the last impulse of the third

selected position, the brush 79 having reached segment 28, the selector set for the code number 8—5—4 has reached a signaling contact position and operates to cause the desired signal to be given, whereupon the agent at the called station answers the telephone and converses with the train dispatcher as shown in detail in Patent 1,343,256, above mentioned. The signal continues until brush 79 passes from segment 48 to segment 49 whereupon the pole changer relay 75 will release and allow a restoring impulse to be sent to restore this selector and all other selectors to normal.

When brush 79 reaches segment 59, a circuit is closed to relay 84 to stop the motor 108 and release the locking relay 86. This circuit may be traced as follows: lower terminal of local battery 76, conductor 77, brush 79, segment 59, conductor 83, winding of relay 84, conductor 85 to upper terminal of battery 76. Relay 84 when operated, momentarily breaks the normally connected armature 90 and contact 91 and thus breaks the circuit to the locking relay 86 which releases causing the release of the line relay 74 and the release of armature 101 in the motor circuit. Relay 84 when operated, also pulls up armature 104 against contact 105 to keep the motor circuit closed while the locking relay 86 is releasing and until the brush 79 has passed from segment 59 to segment 60 whereupon the circuit to relay 84 being broken, the motor circuit is broken and the motor ceases to operate.

Following is a table of code numbers illustrative of various combinations and code settings which may be employed with the system just described.

TOTAL OF CODE SETTINGS

Table No. 1

Total steps in each code—17				Total code settings—78			
2-2-13	3-2-12						
2-3-12	3-3-11	4-2-11					
2-4-11	3-4-10	4-3-10	5-2-10				
2-5-10	3-5-9	4-4-9	5-3-9	6-2-9			
2-6-9	3-6-8	4-5-8	5-4-8	6-3-8	7-2-8		
2-7-8	3-7-7	4-6-7	5-5-7	6-4-7	7-3-7	8-2-7	
2-8-7	3-8-6	4-7-6	5-6-6	6-5-6	7-4-6	8-3-6	9-2-6
2-9-6	3-9-5	4-8-5	5-7-5	6-6-5	7-5-5	8-4-5	9-3-5
2-10-5	3-10-4	4-9-4	5-8-4	6-7-4	7-6-4	8-5-4	9-4-4
2-11-4	3-11-3	4-10-3	5-9-3	6-8-3	7-7-3	8-6-3	9-5-3
2-12-3	3-12-2	4-11-2	5-10-2	6-9-2	7-8-2	8-7-2	9-6-2
2-13-2							
10-2-5							
10-3-4		11-2-4					
10-4-3		11-3-3		12-2-3			
10-5-2		11-4-2		12-3-2		13-2-2	

The above table is for the 17 step code and any of the code settings may be obtained by the setting up on the key selector of the first and last code numbers of each setting. It will be noted that since a single impulse is employed as a clear-up and to restore the selectors to normal, each set of impulses in a code consists of more than one impulse. All stations may be called simultaneously by operating key 0 in the first group and key 0' in the second group or various groups of stations may be called by operating corresponding keys in the first and second groups.

It will readily be seen that by means of the selector key just described, that call connections covering quite a wide range of code settings may be handled, and that in order to set up a call connection requiring three steps of selection, it is only necessary to set up keys representing the first and last code numbers. It will also be apparent that by making various changes in the number of keys and corresponding segments, and connec-

tions between them that this system may be used in connection with a variety of signal codes.

This invention therefore is not considered as being limited to the particular number and arrangement of keys and segments or connections between them as described or to the particular signal code shown, but to a selector system for selectively signaling substations of a system from a central office as set forth in the following claims.

10 What is claimed is:

1. A variable impulse transmitter for transmitting variable codes of impulses, each consisting of three series of impulses with pauses therebetween, the number of impulses in each series being variable while the total number of impulses in each code signal is constant, comprising two groups of keys, the first group designating the number of impulses in the first series, and the second group designating the number of impulses in the third series, a series of fixed contacts, a movable contact to successively engage the fixed contacts, means for driving said movable contact successively over the fixed contacts, alternate contacts of said series of fixed contacts being normally live contacts and the remaining being normally dead, connections between the first group of keys in their numerical order and groups of contacts in sequence beginning with the one at the beginning of the series of contacts for so changing the normal condition of the contacts as to determine the number of impulses in the first series of the code, and connections between the second group of keys in their numerical order and groups of contacts in sequence of the contacts beginning with the one at the end of the series of contacts so changing the normal condition of the contacts to determine by their operation the number of impulses in the third series of the code, the number of impulses in the second series of the code being automatically determined by the intermediate contacts unaffected by the setting of the keys.

2. A variable impulse transmitter for transmitting variable codes of impulses, each consisting of three sets of impulses with pauses therebetween, the number of impulses in each set being variable while the total number of impulses for each code is constant, comprising two groups of keys, namely, a first group for setting the transmitter for the first set of impulses to be transmitted and a second group for setting the transmitter for the third set of impulses to be transmitted, a series of fixed contacts, a movable contact successively engaging the fixed contacts, means to drive said movable contact into successive engagement with the fixed contacts, alternate fixed contacts of said series being normally live contacts, the remaining fixed contacts of said series being normally dead, so that normally the movable contact will engage alternately live and dead contacts, each key in said first group, beginning with the first key in said first group and the first contact of said series, wired to one of said contacts and to the next two alternate contacts succeeding that contact so that by operating a key in the first group the condition of three contacts will be changed, each key but the second in said second group, beginning with the first key in said second group and the last of said series of fixed contacts, wired to one of said contacts and to the next two alternate contacts preceding that contact, so that by operating a key in the second group the condition of three contacts will be changed, the keys in the first and second groups and their associated contacts being so ar-

ranged that by operating a key in the first group and a key in the second group to represent respectively the first and third series of impulses to be transmitted, the second series of impulses of the code and necessary to the complete set-up will be automatically determined by the contacts which have been unaffected by operation of the keys, the second key in said second group being merely a restoring key for the remaining keys in the second group.

3. A variable impulse transmitter for transmitting variable codes of impulses, each consisting of three series of impulses with pauses therebetween, the number of impulses in each series being variable and the number in the complete code being constant, comprising two groups of keys, the first group being operable to determine the number of impulses in the first series, the second group being operable to determine the number of impulses in the third series, a series of fixed contacts, a movable contact to engage the fixed contacts, means to drive the movable contact into successive engagement with the fixed contacts, alternate contacts in said series of fixed contacts, beginning with the first contact of said series, being normally live contacts, the remaining fixed contacts being normally dead, so that normally the movable contact will successively engage alternately live and dead contacts, each key in said first group, beginning with the first key in said first group and the first contact of said series, wired to a fixed contact and to the next two alternate succeeding fixed contacts in said series, each key but the second in said second group, beginning with the first key in said second group and the last contact of said series, wired to a fixed contact and to the next two alternate preceding contacts in said series, each key in the said first and second groups with the exception of the second key in the second group being operable to change the normal condition of three fixed contacts so that by operating any one key in the first group and any one key with the exception of the second in the second group, the condition of six of the fixed contacts in said series will be affected to provide spaces between the three impulse series of the code signal, the second key in said second group being merely a restoring key for the remaining keys in the second group.

4. A variable impulse transmitter to transmit variable codes of impulses each consisting of three series of impulses with pauses therebetween, the number of impulses in each series being variable while the total number in each code signal remains the same, comprising a first and a second group of keys for determining the combination of impulses to be sent for the first, second and third series, a third group of keys operable to permit the sending of additional impulses, a series of fixed contacts for said first and second groups of keys, alternate contacts for said first and second groups, beginning with the first contact of said series, being normally live contacts, the remaining contacts for said first and second groups being normally dead, each of the keys in said first group, beginning with the first key in said first group and the first contact of said series, wired to a contact and to the next two alternate succeeding contacts to that contact, each of the keys with the exception of the second in said second group, beginning with the first key in said second group and the last contact of said series, wired to a contact and to the next two alternate preceding contacts to that contact, a second series of fixed contacts for said third group of keys, alternate

contacts in said second series permanently live contacts, the remaining contacts in said series normally live contacts, a movable contact to successively engage all of the said fixed contacts, 5 means to drive the movable contact into successive engagement with the fixed contacts, the keys in said first and second groups being operable to so change the normal condition of the first series of contacts that when the movable contact successively engages the contacts in said first series 10 a code signal consisting of three spaced series of impulses will be transmitted, and the keys in said third group which have connection with contacts in said second series being operable to change the normal condition of said second series of contacts so that when the movable contact successively engages the contacts in said second series additional impulses to the normal code will be transmitted, the second key in said second group being merely a restoring key for the remaining keys of the second group. 85

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15	90
20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150