

Dec. 13, 1938.

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2,140,138

IMPULSE TRANSMITTER

Filed Feb. 18, 1937

3 Sheets-Sheet 1

FIG. 1

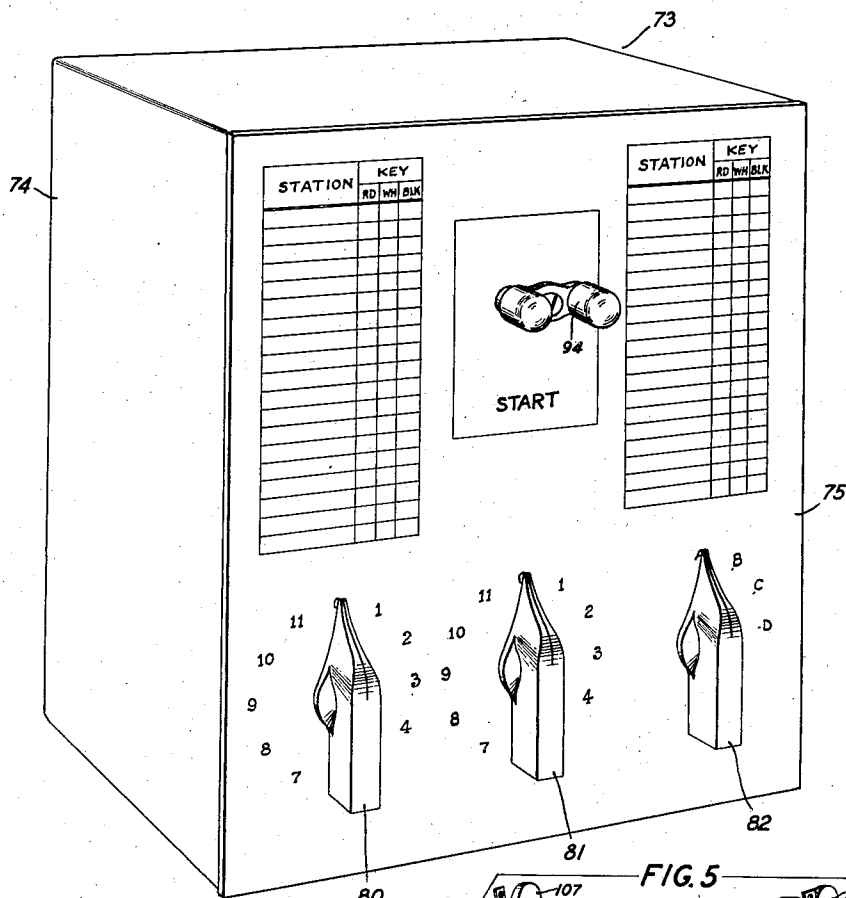


FIG. 4

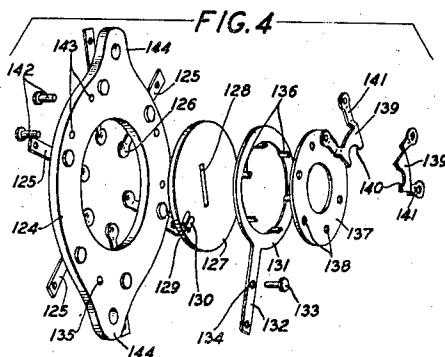
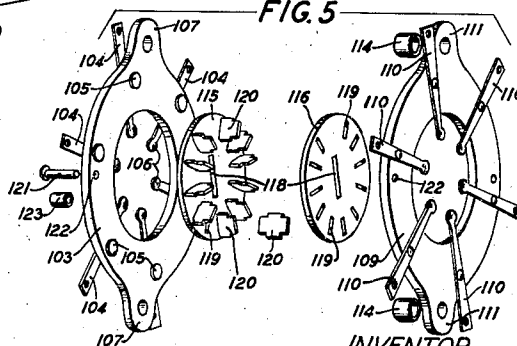


FIG. 5



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FIG. 2

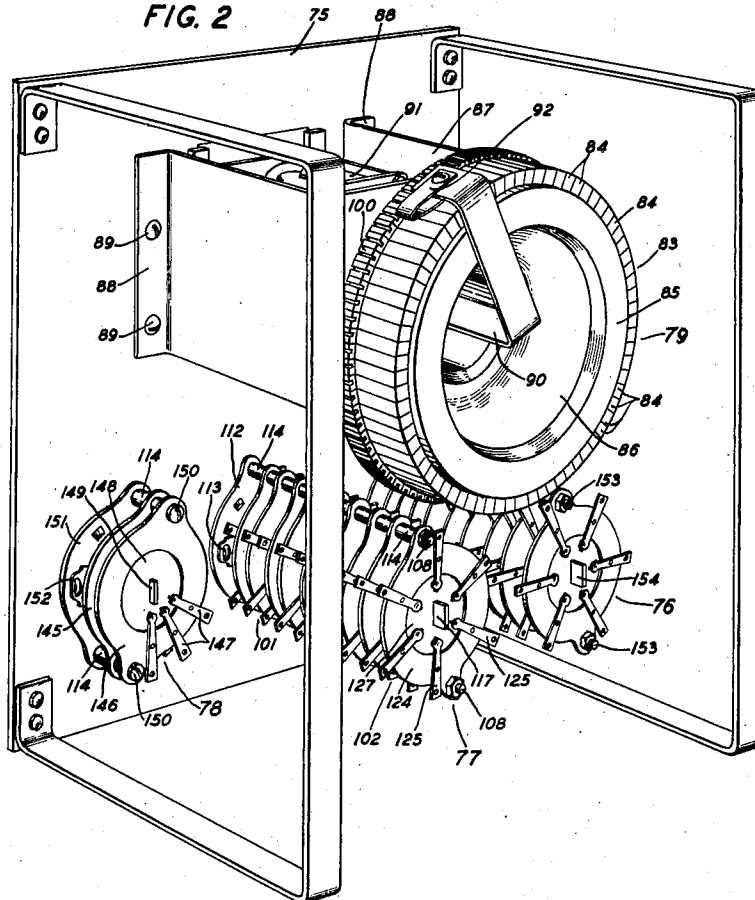
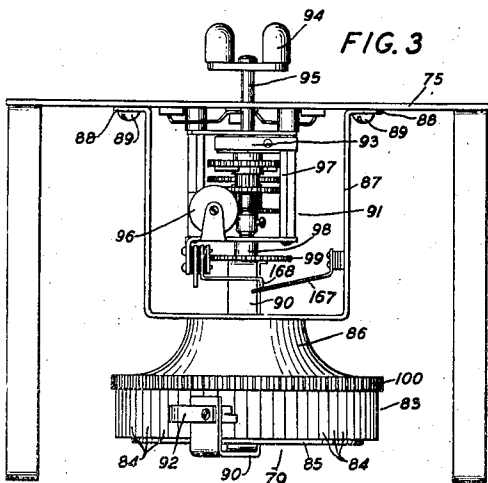


FIG. 3



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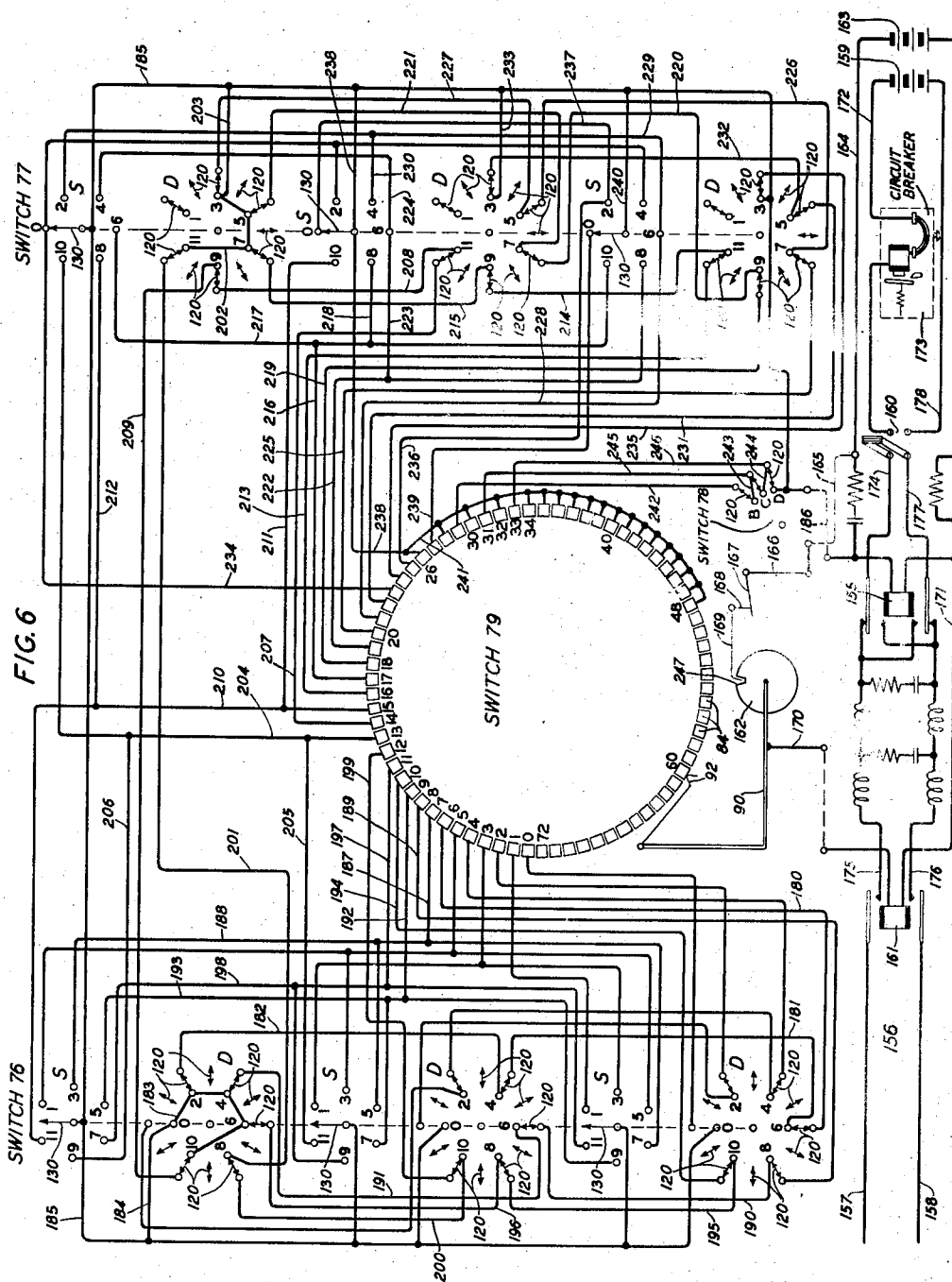
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IMPULSE TRANSMITTER

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3 Sheets-Sheet 3



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2,140,138

IMPULSE TRANSMITTER

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Application February 18, 1937, Serial No. 126,410

3 Claims. (Cl. 177—380)

This invention relates to signal transmitting devices for electrical communication systems and more particularly to code signal transmitting devices.

5 The object of this invention is to provide a signal impulse sender which is simple in construction and of low cost to manufacture and which will give reliable and satisfactory service over a comparatively long period of time.

10 A feature of the invention resides in the combination of a plurality of manually operated rotary switches with a motor driven commutator type switch and a relay adapted to control signal line contacts, the manually operated switches providing means for setting the device to transmit a required code signal and the commutator type switch serving to control the relay in accordance with the code signal setting.

In the drawings:

20 Fig. 1 is a front view in perspective of the impulse sending device;

Fig. 2 is a rear view in perspective of the device when a cover is removed;

Fig. 3 is a top plan view of the device shown in Fig. 2 and drawn on a slightly smaller scale than Fig. 2;

Fig. 4 is a view in perspective of parts of one of the rotary switch elements used in the device, the parts being shown in their relative positions before being assembled. The parts in Fig. 4 are drawn on an enlarged scale relative to Fig. 2;

Fig. 5 is a view in perspective of parts of another of the rotary switch elements used in the device, the parts being shown in their relative positions before being assembled. The parts in Fig. 5 are drawn to the same scale as Fig. 4; and

Fig. 6 is a schematic diagram of the impulse sending device and of a portion of a signal system in which the device may be used, the impulse sending device of the invention when used in combination with certain elements in the signal system serving to send code signal impulses over the line wires of the system.

The code signal transmitting device may be used in a selective signal system in which selectors at substations are remotely controlled by means of signal impulses sent over the line wires of the system.

This invention while not necessarily limited to such use has been found particularly well adapted for use in a selective signal system used in train dispatching wherein a plurality of selectors of the type described in Patent 1,343,256 issued June 15, 1920, are located at substations and are remotely controlled from a train dispatcher's station. The

selectors are operated 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 selector have been received, that selector will operate to close a circuit to a signal device to cause the sounding or display of a suitable signal at that particular substation.

The code signal transmitting device may be used in place of a plurality of selector keys of the type shown and described in Patent 1,306,054 issued June 10, 1919, and also in place of the impulse sender shown and described in Patent 1,976,548 issued October 9, 1934.

With reference to the drawings and in which like parts in the figures bear like numerals, 73 is a box-like container comprising a cover 74 and a control panel 75. The cover 74 is in the form of a rectangular box with one open face and serves to cover apparatus mounted on the control panel 75 and projecting rearwardly from the control panel 75. The control panel 75, as shown in Fig. 2, supports manually operated rotary type switches 76, 77 and 78 and a motor driven commutator type switch 79. The manually operated switches 76 and 77 are used in setting the device to transmit a predetermined code signal. The switch 78 is used in setting the device to send impulses additional to the settings made by operation of switches 76 and 77. The commutator type switch 79 serves to control operation of a relay in accordance with the settings of the switches 76, 77 and 78, the relay controlling line contacts of the signal system as will be later explained.

The switches 76, 77 and 78 each comprises spaced flat rings of insulating material supporting spaced fixed contacts, movable contacts to selectively engage the fixed contacts, a shaft to operate the movable contacts and a manually operated control handle to operate the shaft. The control handles for the switches 76, 77 and 78 are located outside of the container 73, as shown in Fig. 1, and the remaining portions of the switches extend rearwardly from the rear face of the control panel 75, as shown in Fig. 2, the control panel 75 being apertured to accommodate the shafts of the switches 76, 77 and 78. The control handles 80, 81 and 82, shown in Fig. 1, apply to the respective switches 76, 77 and 78, shown in Fig. 2.

The commutator type switch 79, as shown in Figs. 2 and 3, comprises a ring 83 of insulatingly spaced segmental fixed contacts 84, the contacts 84 being insulatingly supported on a ring 85 of insulating material. The ring 85 has a tubular

neck portion 86 attached to a yoke 87. The yoke 87 has outwardly turned apertured flanges 88 on its free end portion and is secured to the rear surface of the control panel 75 by suitable fastening means 89. The yoke 87 is apertured at its closed end to permit extension therethrough of an arm 90. The arm 90 is L-shaped and is secured at one end to a motor 91 and carries on its free end a brush contact 92, the brush contact 92 engaging successively the segmental contacts 84. The brush contact 92 is so formed that some portion of it is always in engagement with a segmental contact 84.

I have found that a spring driven motor of the type employed in the impulse transmitter shown in Patent 1,306,054 issued June 10, 1919 and which is commonly known as a selector key, serves quite well as a motor for driving the brush contact 92 over the segmental contacts 84 and reference to this patent may be had for a full understanding of the structure of the motor. The motor 91, therefore, is shown as being a spring driven motor in which a spring 93 is manually wound by means of a handle 94. The handle 94 is located outwardly of the front face of the control panel 75 and is mounted on a shaft 95, the shaft 95 projecting through an aperture in the control panel 75. The driving mechanism of the motor 91 is located rearwardly of the rear face of the control panel 75 in the space defined by the yoke 87 and is supported by suitable means on the rear face of the control panel 75. The motor 91 includes a governor 96 which serves to control the speed of operation of the brush contact 92 over the segmental contacts 84. When the motor is to be operated, the handle 94 is manually turned to wind up the spring 93. Upon release of the handle 94 the spring 93 through a gear train 97 causes rotation of a shaft 98. A wheel 99 is secured to the shaft 98. The arm 90 carrying the brush contact 92 is secured to the wheel 99. The spring motor 91, therefore, rotates arm 90 and causes the brush contact 92 to successively engage the segmental contacts 84. Each segmental contact 84 has a bifurcated heel portion 100 which serves as a point of connection for a conductor wire. The conductor wires are not shown in Figs. 2 and 3, but are shown only in Fig. 6 in order to simplify the drawings. The conductor wires, as will be subsequently pointed out, however, serve as electrical connections between the segmental contacts 84 and predetermined contacts in the rotary switches 76, 77 and 78.

The rotary switches 76 and 77 are alike in construction and each switch has double and single switch elements. In order to simplify the specification, only one of these switches will be described in detail. Switch 77, for instance, comprises two sets of flat rings of insulating material. The first set, generally designated by the number 101, contains the double switch elements and comprises three pairs of rings of insulating material. The second set, identified by the number 102, contains the single switch elements and comprises three separate rings of insulating material. The rings of insulating material and parts cooperating therewith to form the switch are shown in detail in Figs. 4 and 5. Fig. 5 shows the construction of parts of a double switch element. Fig. 4 shows parts of one of the single switch elements. The ring 103 of insulating material, as shown in Fig. 5, serves as a support for a set of spaced fixed contacts 104. The spaced fixed contacts 104 are secured by means of

rivets 105, or by other suitable fastening means to one face of the ring 103 and project inwardly of the ring 103. The contacts 104 are in the form of spring fingers and have an embossed inner end 106 disposed within the open space defined by the ring 103. Apertured ear portions 107 are provided on the ring 103 to permit mounting of the ring 103 on suitable supporting rods 108 in spaced relation with other rings of the set, as shown in Fig. 2. A ring 109 of like structure to the ring 103, and as shown in Fig. 5, serves as the other ring of the pair. Spaced fixed contacts 110 are supported on the ring 109. The contacts 110 are of like structure to the contacts 104 on the ring 103. Apertured ear portions 111 are provided on the ring 109 to receive the supporting rods 108. The rings 103 and 109 arranged in pairs are mounted on the supporting rods 108—108 along with rings of the single switch element above mentioned and which will be subsequently described. The supporting rods 108 are secured at one end to a ring 112 and the ring 112 serves in cooperation with a roller supporting arm 113 as a detent device for the switch. An operating shaft 117 of the switch extends through the control panel 75 and through clamping means, not shown, the clamping means serving to hold the switch against the control panel 75. Tubular spacers 114 supported on the rods 108 and disposed between the rings of insulating material, serve to hold the rings in spaced relation. Two discs 115 and 116 of insulating material are mounted in spaced relation on the shaft 117. The disc 115 fits into the space defined by the ring 103 and is rotatable therein. The disc 116 fits into the space defined by the ring 109 and is rotatable therein. In each disc there is an elongated aperture 118 in the central portion to receive the shaft 117. A series of elongated apertures 119 is provided in each disc 115 and 116 and near the periphery of each disc. The apertures 119 are spaced apart equal to one-half of the spacing of the embossed ends of adjacent contacts of the fixed contacts 104 or 110 with the exception that at one point there is a double space, the contacts referred to being supported by the respective rings 103 and 109. That is to say, the apertures 119 in the disc 115 are so spaced that alternate apertures are in alignment with the embossed ends 106 of the contacts 104 supported by the ring 103, and alternate apertures 119 in the disc 116 are so spaced as to be in alignment with the embossed ends of the contacts 110 supported by the ring 109. The number of apertures 119 in each disc is equal to double the number of contacts supported by each ring less one. For instance, there are six contacts 104 supported by the ring 103 and there are eleven apertures 119 in the disc 115. There are six contacts 110 supported by the ring 109 and there are eleven apertures 119 in the disc 116. When the rings 103 and 109 are mounted on the rods 108, as shown in Fig. 2, and the discs 115 and 116 are mounted on the shaft 117, the embossed ends 106 of the contacts 104 and of the contacts 110 and the alternate apertures 119 in the discs 115 and 116 are in alignment.

A set of bridging contacts 120 is carried by the discs 115 and 116. The bridging contacts 120 are comparatively short flat pieces of conducting material reduced in width at each end to fit into the elongated apertures 119 in the discs 115 and 116 and to extend through the apertures 119 and slightly beyond the outer faces of the discs so as to make contact with the embossed ends 106 of

the contacts supported by the rings 103 and 109. In Fig. 5 the bridging contacts 120 with the exception of one are all shown fitted into the apertures 119 in the disc 115. The free ends of the contacts supported in disc 115 will fit into corresponding apertures in the disc 116 when the parts are put together. The remaining bridging contact is shown in position ready to be fitted to the discs 115 and 116. When the switch is assembled, the discs 115 and 116 are supported on the shaft 117 and the bridging contacts 120 are cooperatively supported by the discs 115 and 116. The rings 103 and 109 are kept spaced apart by means of the spacers 114 which are threaded on the rods 108. Rivets 121 which pass through aligned apertures 122 in the rings 103 and 109 serve to hold the parts together. Spacers 123 are provided on the rivets to further maintain the rings 103 and 109 spaced apart the required distance. Ends of the bridging contacts 120 engage corresponding embossed ends 106 of the contacts 104 supported by the ring 103 and embossed ends of the contacts 110 supported by the ring 109. All but one pair of contacts in the rings 103 and 109 are bridged by the bridging contacts 120 when the switch is in certain positions. In other positions all the fixed contacts are bridged at the same time. For instance, if the parts shown in Fig. 5 are assembled, contacts 104 supported by ring 103 will be conductively connected by means of the bridging contacts 120 to corresponding contacts 110 supported on the ring 109, that is, with the exception of the contacts in the uppermost position. Since normally there is no bridging contact 120 for this position, the uppermost contact 104 on ring 103 will not be electrically connected to the uppermost contact 110 on ring 109. When shaft 117 is turned by means of the manually operated handle 81, the bridging condition is changed accordingly. The switch is provided with a detent 113 and moves in steps, each step being the distance of one-half space between adjacent fixed contacts on a ring. Rotation of the handle 81, for instance, one step in a clockwise direction to the first number from zero position on the front face of the control panel 75 will result in the bridging of all of the fixed contacts. Rotation for one step more will result in unbridging of the first fixed contacts to the right of the uppermost contacts 104 and 110 supported by the respective rings 103 and 109.

As shown in Fig. 2, there are three of the single switch elements controlled by means of the shaft 117 which is also common to the double switch elements above described. In Fig. 4 parts of one of the single switch elements are shown. Each single switch element comprises a ring of insulating material 124. Supported by means of the ring 124 are spaced fixed contacts 125 corresponding in structure and arrangement to the fixed contacts 104 in the double switch element above described. The fixed contacts 125 project inwardly within the space defined by the ring 124 and have embossed inner ends 126. A disc 127 of insulating material is provided to carry a movable contact of the switch element. An elongated aperture 128 is provided in the central portion of the disc 127. The disc 127 fits into the space defined by the ring 124 of insulating material and has an elongated aperture 129 formed near its periphery, the aperture 129 being adapted to be brought into alignment with an embossed inner end 126 of a contact 125. In the elongated aperture 129 a contact 130 is

set. The contact 130 is in the form of a rivet or staple and has portions upset or flanged over on opposite faces of the disc 127. One end of the contact 130 selectively engages the embossed ends 126 of the fixed contacts 125. The other end of the contact 130 frictionally engages a collector ring contact 131. The collector ring contact 131 is provided with a terminal 132 which is secured by means of a rivet 133 to the ring 124 of insulating material, the rivet 133 being extended through an aperture 134 in the terminal 132 and through an aperture 135 in the ring 124 and then spun over or upset against the surface of the ring 124 to hold the terminal 132 in position. Spaced lugs 136 are provided on the collector ring 131. A ring 137 of insulating material is provided to bear against the collector ring 131 to keep the collector ring 131 pressed against one end of the contact 130 and to maintain the disc 127 in the space defined by the ring 124. The ring 137 is apertured at a plurality of points 138 in alignment with the spaced lugs 136 of the collector ring 131. The free ends of the lugs 136 are turned over against the outer face of the ring 137 to hold the collector ring 131 and the ring 137 of insulating material together. Clamps 139 are provided to clamp the ring 137 and the collector ring 131 in place against the disc 127. The clamp 139 has a bifurcated free end portion 140 which fits over a portion of the ring 137. Apertured leg portions 141 on the clamp 139 are offset from the plane of the clamp and bear against the ring 124. The leg portions 141 are secured to the ring 124 by means of rivets 142 which extend through apertures 143 in the ring 124 and through the apertures in the legs 141 of the clamp 139. To simplify the drawings only two of the rivets 142 have been shown and these rivets are in a position for securing the uppermost clamp. It is to be understood, however, that the clamp 139 shown on the extreme right of the figure is secured in like manner to the ring 124. The clamps 139, therefore, serve to hold the ring 137, the collector ring 131 and the disc 127 in a required position relative to the ring 124.

In Fig. 2 three of the rings 124 assembled with the parts just described are provided as the single switch elements in the structure of the switches 76 and 77. Fig. 4 shows a front view in perspective of the parts and Fig. 2 shows the assembled parts in perspective viewed from the rear of the assembly. Shaft 117, as shown in Fig. 2, extends through the elongated apertures 128 in the discs 127. The rings 124, as shown in Fig. 2, are mounted on the rods 108, the rods 108 passing through aperture ear portions 144 of the rings 124. The rings 124 are held in spaced relation by means of the spacers 114 supported on the rods 108. When the shaft 117 is turned, for instance, by manual operation of the handle 81, the discs 127 are rotated within the rings 124. When the contacts 130 are in engagement with corresponding fixed contacts and the handle is turned one step, contacts 130 will be moved out of engagement with the embossed ends 126 of the contacts 125 with which they were left in engagement at the last setting of the switch and to a position where they will not engage a fixed contact. Another one-step movement will bring the contacts 130 into engagement with the next contact 125. As the knob 81 is manually rotated the contacts 125 are successively engaged by the associated contacts 130 upon each second step movement of the switch.

The switch 78, as shown in Fig. 2, comprises two rings 145 and 146 of insulating material. The rings correspond in structure to the rings 103 and 109 shown in Fig. 5. Each ring 145 and 146, however, supports only three contacts 147 which correspond in structure to the contacts 104 and 110. In the space defined by each ring 145 and 146 there is a disc 148 centrally apertured to receive the shaft 149. Bridging contacts, not shown, but corresponding in structure to the bridging contacts 120 of the double switch element arrangement shown in Fig. 5, are provided to normally bridge the contacts 147 supported by the rings 145 and 146. The rings 145 and 146 are supported by means of the rods 150. The rods 150 are attached to a ring 151 and the ring 151 serves in cooperation with the roller arm 152 as a detent to limit each movement of the switch to a definite step. The switch assembly is held in place on the control panel 75 by suitable clamping means, not shown. Spacers 114 supported on the rods 150 serve to maintain the rings 145, 146 and 151 in required spaced relation. Since the switch 78 is constructed like one of the double element arrangements in the portion 101 of the switch 77 and the switch 77 has been described in detail, further description of the switch 78 is considered unnecessary, the only difference being in the number and spacing of the fixed and movable contacts and that the switch 78 contains only a double element arrangement.

To explain the function and operation of the switches 76, 77 and 78 and of the commutator type switch 79, reference will now be had to Fig. 6 in the drawings. In Fig. 6 the switches above mentioned are shown in connection with a portion of the system adapted to send code signal impulses over line wires to operate selectors at remote points. The apparatus shown in Fig. 6 might be located at a train dispatcher's station and operate to send code signal impulses to substations to selectively operate selectors at the substations, the selectors operating to control signal devices. The selectors are not shown since they do not form part of the present invention and they may be of a well-known type such, for instance, as shown in Patent 1,343,256 as previously mentioned. Switches 76, 77, 78 and 79 are identified in Fig. 6 by suitable legends. Switches 76 and 77, as above mentioned, are alike in structure and each comprises single and double switch elements shown respectively in Figs. 4 and 5. There are three single switch elements and three double switch elements in each switch 76 and 77. The single and double switch elements in switch 76, as shown in Fig. 2, are supported in spaced relation on the rods 153 which correspond to the rods 108 in switch 77. The single and double switch elements in switch 76 are controlled through operation of a common shaft 154 which corresponds to the shaft 117 in switch 77. The shaft 154 for switch 76 extends through the control panel 75 into operative engagement with the control handle 80. Contacts in the single and double switch elements, as shown in Fig. 6, are wired to segmental contacts of the switch 79. To simplify the drawings, the structures of the single and double switch elements shown in Figs. 4 and 5 are not shown in Fig. 6. The single and double switch elements, however, are identified by the letters S and D, respectively, in Fig. 6. Switch 78 does not contain any single switch element, but only a double switch element of the type shown

in Fig. 5, but having only three pairs of fixed contacts and three movable contacts.

The switches 76, 77, 78 and 79, as shown in Fig. 6, are used to control the operation of a pole changer relay 155, the pole changer relay 155 serving to control transmission of signal impulses over a line system 156 in which selectors, not shown, are included, the selectors being located at substations on the line and being connected across the line conductors 157 and 158. The line system is supplied with current from a suitable source of current supply such, for instance, as the main battery 159, when the double pole single throw switch 160 is closed and the line relay 161 is energized.

When the switches 76, 77 and 78 are in normal positions, such as shown in Fig. 6, and the control handles 80, 81 and 82 are in the position shown in Fig. 1 and the switch 160 is closed, the code signal transmitting device of this invention will send, for instance, seventeen impulses when the commutator type switch 79 is operated. To operate the commutator type switch 79 the handle 94 is manually turned to wind up the spring motor 91. Upon release of the handle 94 the brush contact 92 of the commutator type switch 79 is driven by means of the spring motor 91 over the segmental contacts 84 and successively engages each segmental contact. The spring motor 91 also causes rotation of a wheel 162 which moves simultaneously with and at the same speed as the brush contact 92. The wheel 162 closes a circuit for the line relay 161, the circuit for this relay remaining closed for one complete cyclic movement of the brush contact 92. The circuit for the line relay 161 may be traced as follows: Local battery 163, conductor 164, conductor 165, conductor 166, closed contacts 167 and 168, spring contact finger 169, conductor wheel 162, arm 90, conductor 170, winding of line relay 161, conductor 171, to local battery 163. Line relay 161 will therefore be energized and complete through its front contacts and armatures the circuit from the main battery 159 to the line wires 157 and 158. The line circuit may be traced as follows: Main battery 159, conductor 172, circuit breaker 173, upper pole of closed double pole single throw switch 160, conductor 174, back contact and upper armature of pole changer relay 155, conductor 175, upper front contact and upper armature of line relay 161, line wire 157, the windings of selectors, not shown, line wire 158, lower armature and front contact of line relay 161, conductor 176, back contact and lower armature of pole changer relay 155, conductor 177, lower pole of closed switch 160, conductor 178 to main battery 159. Energization of the line relay 161 results in the sending of a single impulse over the line wires. Each selector at the substations, not shown, moves a contact one step toward the fixed contact on this impulse, but since none of the selectors is set to hold at one step and the wiper contact 92 of the commutator type switch 79 normally rests on a blank segmental contact 84 and has to travel over several blank segmental contacts 84 before the code signal begins, the selectors during this interval all return to normal position. The motor 91 continues to drive the brush contact 92 over the segmental contacts 84.

The commutator type switch 79 is shown in Fig. 6 as having seventy-three segmental contacts 84. The switch, however, may have a few more or less of these segmental contacts and still be operative for this invention. The number of segmental contacts shown, however, has been

found convenient since standard rings of this number of contacts are available and the unconnected contacts provide a pause period sufficient to allow the selectors to restore after the initial impulse is sent when the switch 160 is closed and the line relay 161 is energized. The brush contact 92, therefore, normally rests on about the sixtieth or sixty-first segmental contact, the segmental contacts 84 being numbered consecutively from 0 to 72.

When the brush contact 92 passes from segmental contact 72 to contact 0, it enters the portion of the ring of segmental contacts associated with the switches 76, 77 and 78. Assuming that the switches 76, 77 and 78 are set for normal condition, that is, with the pointers of the control handles 80, 81 and 82 pointing directly upward, as shown in Fig. 1, the first energization of the pole changer relay 155 takes place when the brush contact 92 engages segmental contact 6. The circuit for the energization of the pole changer relay 155 through this point may be traced as follows: Local battery 163, conductor 164, conductor 165, conductor 166, closed contacts 167 and 168, spring contact 169, wheel 162, arm 90, brush contact 92, segmental contact 6, conductor 183, bridging contact 120 in position 6 of lowermost double element of switch 76, conductor 181, bridging contact 120 in position 4 of central double element of switch 76, conductor 182, bridging contact 120 in position 2 of uppermost double element of the switch, strap conductor 183 to position 0, conductor 184, conductor 185, conductor 186, winding of pole changer relay 155, conductor 171 to local battery 163. The pole changer relay 155 will pull its upper and lower armatures against the associated front contacts and cause the sending of an impulse out over the line system 156, the impulse being in the opposite direction to that sent when the line relay 161 was first energized. The impulse sent over the line system 156 causes each of the selectors at the substation to step a movable contact one step forward toward a fixed contact. When the wiper contact moves off segmental contact 6 and on to segmental contact 7, the pole changer relay 155 is deenergized since there is no circuit to the pole changer relay, segmental contact 7 being connected by conductors 187 and 188 only to contacts in the single elements of the switch not closed by a movable contact 130. The deenergization of the pole changer relay 155 causes release of its armatures and the armatures move back against their associated back contacts. In this position an impulse is sent over the line system 156 of reverse polarity to the impulse preceding. The selectors at the substations therefore step their movable contacts forward another step toward a fixed contact. On segment 8 the pole changer relay 155 is energized over a circuit including segment 8, conductor 189, bridging contact 120 in position 8 of lowermost double element of switch 76, conductor 190, bridging contact 120 in position 6 of the central double element, conductor 191, bridging contact 120 at position 4 of uppermost double element, strap conductor 183 to position 0, conductor 184 and conductor 185. On segment 9 the pole changer relay is deenergized since this segment is connected by conductors 192 and 193 only to contacts of the single elements not engaged at this time by the movable contacts 130. On segment 10 the pole changer relay is energized over a circuit including segment 10, conductor 194, bridging contact 120 in position 10 of lowermost double element of

switch 76, conductor 195, bridging contact 120 in position 8 of the central double element of switch 76, conductor 196, bridging contact 120 in position 6 of the uppermost double element of the switch, strap conductor 183, conductor 184, conductor 185. On segment 11 the pole changer relay 155 is deenergized since conductors 197 and 198 lead only to fixed contacts of the single elements not engaged by movable contacts 130. On segment 12 the pole changer relay is energized over conductor 199, bridging contact 120 in position 10 of central double element, conductor 200, bridging contact 120 in position 8 of uppermost double element, conductor 201, bridging contact 120 in position 11 of uppermost double element of switch 77, strap conductor 202, conductor 203 and conductor 185. On segment 13 the pole changer relay is deenergized since conductors 204, 205 and 206 are not connected to fixed contacts in engagement with movable contacts 130 of the single elements of the switches 76 and 77. On segment 14 the pole changer relay is energized over conductor 207, bridging contact 120 in position 11 of central double element of switch 77, conductor 208, bridging contact 120 in position 9 of uppermost double element of switch 77, conductor 209, bridging contact 120 in position 10 of uppermost double element of switch 76, strap conductor 183, conductor 184 and conductor 185. On segment 15 the pole changer relay is deenergized since conductors 210, 211 and 212 are connected to fixed contacts in single elements of the switches 76 and 77 not in engagement with movable contacts 130. On segment 16 the pole changer relay 155 is energized over conductor 213, bridging contact 120 in position 11 of lowermost double element of switch 77, conductor 214, bridging contact 120 in position 9 of central double element, conductor 215, bridging contact 120 in position 7 of uppermost double element, strap conductor 202, conductor 203 and conductor 185. On segment 17 the pole changer relay is deenergized since conductors 216, 217 and 218 are connected to fixed contacts in the single elements of switch 77 not in engagement with movable contacts 130. On segment 18 the pole changer relay 155 is energized over conductor 219, bridging contact 120 in position 9 of lowermost double element of switch 77, conductor 220, bridging contact 120 in position 7 of central double element, conductor 221, bridging contact 120 in position 5 in uppermost double element, strap conductor 202, conductor 203 and conductor 185. On segment 19 the pole changer relay is deenergized since conductors 222, 223 and 224 are connected to fixed contacts in the single elements of the switch 77 not in engagement with movable contacts 130. On segment 20 the pole changer relay is energized over conductor 225, bridging contact 120 in position 7 of lowermost double element of switch 77, conductor 226, bridging contact 120 in position 5 of central double element, conductor 227, bridging contact 120 in position 3 of uppermost double element, conductor 233 and conductor 185. On segment 21 the pole changer relay is deenergized since conductors 228, 229 and 230 are connected to fixed contacts in the single elements of switch 77 not in engagement with the movable contacts 130. On segment 22 the pole changer relay 155 is energized over conductor 231, bridging contact 120 in position 5 of lowermost double element of switch 77, conductor 232, bridging contact 120 in position 3 of central double element, conductor 233 and conductor 185. On segment 23 the pole changer relay 155 is held

energized over conductor 234, fixed contact in position 0 of uppermost single element of switch 77, movable contact 130 and conductor 135. On segment 24 the pole changer relay 155 is held energized over conductor 235, bridging contact 120 in position 3 in lowermost double element, conductor 135. On segment 25 the pole changer relay is held energized over conductor 236, conductor 237, fixed contact in position 0 of central single element of switch 77, movable contact 130 in the same position, conductor 238 and conductor 135. On segment 26 the pole changer relay is held energized over conductor 238 and conductor 135. On segment 27 the pole changer relay 155 is held energized over conductor 239, fixed contact and the movable contact 130 in position 0 in the lowermost single element of switch 77, conductor 240 and conductor 135. On segment 28 the pole changer relay is held energized since this segment is connected by the strap conductor 241 to conductor 238. On segment 29 the pole changer relay is held energized over conductor 242, bridging contact 120 in the B position of the double element in switch 78, strap conductor 243 between the B and C positions of the switch 78, bridging contact 120 at the C position, strap conductor 244 between the C and D positions, bridging contact 120 at the D position and conductor 136. On segment 30 the pole changer relay is held energized over strap conductor 241, conductor 238 and conductor 135. On segment 31 the pole changer relay is held energized over conductor 245, bridging contact 120 at the C position of switch 78, strap conductor 244, the bridging contact 120 at the D position of the switch and conductor 136. On segment 32 the pole changer relay is held energized since this segment is connected by the strap conductor 241 to conductor 238. On segment 33 the pole changer relay is held energized over conductor 246, bridging contact 120 at the D position of switch 78 and conductor 136. Segments 34 to 48, inclusive, are all strap connected by strap conductor 241 to conductor 238. The pole changer relay 155, therefore, is maintained energized while the brush contact 92 is passing over these contacts and successively engages them. This provides a signaling period for signal apparatus, not shown, but located at the substation.

It is to be noted that when the switches 76, 77 and 78 are set in the positions indicated in Figs 1 and 6, seventeen impulses are sent over the line system through successive energization and deenergization of the pole changer relay 155, from the time the brush contact 92 engages segment 6 to its arrival on segment 22 and that each impulse is of opposite polarity to the one preceding since the pole changer relay 155 in effect reverses the battery connections to the line wires 157 and 158. The selectors at the substations each operates to move a movable contact one step toward a fixed contact on each impulse when the impulse received is of opposite polarity to the one preceding. The selectors, therefore, all step together and bring their movable contacts into engagement with the associated fixed contacts. Each selector may control signal apparatus located at the substations served by the selectors, the signal apparatus being operated when the selector moves its movable contact a predetermined number of steps and into engagement with the fixed contact. The selectors are set to hold at a certain predetermined position and will restore to normal starting position when an impulse followed by a comparatively long pause is

received after they have reached the holding position. Segments 49 to 72, inclusive, are blank segments since they are not electrically connected to any of the contacts of switches 76, 77 and 78. When the brush contact 92 passes from segment 48 to segment 49, the pole changer relay is deenergized and remains deenergized for the remaining portion of the cyclic movement of the brush contact 92 over the segmental contacts of the commutator type switch 79. The selectors therefore receive a single impulse followed by a comparatively long pause and restore to normal starting position. The brush contact 92 continues to move over the segmental contacts until it reaches segment 60. Stop means are provided in the spring motor unit 91 to stop the driving of the brush contact 92 at this point. The wheel 162 at this time has completed its cyclic movement and a notch 247 in the periphery of the wheel 162 is in register with a bent end of the contact spring 169 so that at this point the contact spring 169 is not in engagement with the wheel 162. The holding circuit for the line relay 161 is therefore open and the line relay 161 is deenergized to cause opening of the line system.

It is to be noted that when the switches 76 and 77 are in the positions indicated in Figs. 1 and 6, the bridging contacts 120 in the double elements of switches 76 and 77 bridge all contacts in the double elements except those at 0 positions and that there are bridging contacts 120 standing between the fixed contact positions. The movable contacts 130 in the single switch elements of switch 76 normally stand at the 0 positions and not in engagement with a fixed contact. The movable contacts 130 in the single switch elements of switch 77 normally stand at the 0 positions and in engagement with fixed contacts. The switches 76 and 77 are each provided with a detent device as above mentioned. The detent device regulates movement of the movable contacts to one-step movements equal to half the distance between the fixed contact positions. A one-step movement of the switch, therefore, in switch 76 will bring the movable contacts 130 into engagement with fixed contacts at positions 1 and will bring bridging contacts 120 of the double switch elements across all of the fixed contact positions. A second one-step movement will bring the movable contacts 130 between fixed contact positions and will remove the bridging contacts 120 from the positions 2 in the double elements. A one-step movement in switch 77 will bring the movable contacts 130 off their 0 positions where they rest on fixed contacts and midway between positions 0 and 2. The fixed contacts in the double elements of switch 77 will be all bridged by the bridging contacts 120 except at position 1. The blank sections of the discs 115 and 116 of the double elements will be at position 1. That is to say, in this position the portion of the disc 115 not carrying the bridging contact 120 will be in position 1 and all other positions will be bridged by the bridging contacts 120. It will be seen, therefore, that by turning the handles 80 and 81 of the respective switches 76 and 77, different code settings may be made and that the pole changing relay 155 may be controlled to send different code signals, the code signals comprising three separate series of impulses with pauses between each series and that the total number of impulses will be seventeen. For instance, when the switches 76 and 77 are each turned to position 6, the device will operate to send a code signal of three series of

impulses in the order of 6—5—6 with pauses between each series. In this position of the switches there will be no bridging contacts at positions 5 in the double elements of switch 76. The movable contacts 130 of the single elements of this switch will not be in engagement with the fixed contacts. In switch 77 there will be no bridging contacts in positions 6 of the double elements. The movable contacts 130 in switch 77, however, will be in engagement with fixed contacts at positions 6. The pole changer relay 155, therefore, will be energized when the brush contact 92 of the commutator switch 79 engages segment 0, deenergized on segment 1, energized on segment 2, deenergized on segment 3, energized on segment 4, deenergized on segment 5. This gives six impulses for the first series. The pole changer relay after being deenergized on segment 5 remains deenergized while the brush contact 92 is passing over segments 6 to 11, inclusive. This provides the pause period required between the first and second series of impulses. The second series then begins, the pole changer relay being energized on segment 12, deenergized on segment 13, energized on segment 14, deenergized on segment 15 and energized on segment 16. This gives five impulses for the second series. The pole changer relay after being energized on segment 16 remains energized while the brush contact 92 is passing over segments 17 to 22, inclusive. This provides the pause period required between the second and third series of impulses. The third series then begins, the pole changer relay being deenergized on segment 23, energized on segment 24, deenergized on segment 25, energized on segment 26, deenergized on segment 27 and energized on segment 28. This gives six impulses for the third series. The pole changer relay after being energized on segment 28 then remains energized while the brush contact is passing over segments 29 to 48, inclusive. This provides a ringing or other signal period for the signal device, not shown, but controlled by means of the selector at the substation selected. When the brush contact 92 passes from segment 48 to segment 49 the pole changer relay is deenergized and remains deenergized while the brush contact 92 coasts along to segment 60. A single impulse therefore is sent when the brush contact engages segment 49 and this single impulse is followed by a comparatively long pause and the selector at the selected substation restores to normal condition.

The switch 78 provides a means for increasing the number of impulses by two, four or six impulses so that a total of nineteen, twenty-one or twenty-three impulses may be sent by the impulse sending apparatus. The double elements in the switch 78 at the B, C and D positions are normally bridged by the bridging contacts 120. Under this condition a total of seventeen impulses will be sent. When the handle 82 of the switch 78 is moved to the B position the bridging contacts 120 are all moved one step in a clockwise direction. In this operation the bridging contact 120 at the B position is moved from the B position to the C position. The bridging contact normally at the C position is moved to the D position and the bridging contact 120 normally at the D position is moved one step away from its normal position. Therefore, the fixed contacts at the B position will be unbridged and those at the C and D positions will be bridged. Under this condition when the brush contact 92 engages segmental contact 29 the pole changer relay is de-

energized. On segmental contact 30 the pole changer relay is energized and is then held energized while the brush contact is passing over segments 31 to 48, inclusive. This provides two additional impulses, the total number of impulses being nineteen. When the switch 78 is moved another step in a clockwise direction the fixed contacts are bridged only at the D position. Under this condition the pole changer relay 155 is deenergized on segment 31 and energized on segment 32 and is held energized on segments 33 to 48, inclusive. This provides four additional impulses making a total of twenty-one. When the switch handle 82 is moved to the D position, all of the bridging contacts 120 in switch 78 are out of engagement with the fixed contacts. Under this condition the pole changer relay is deenergized on segment 33 and energized again on segment 34 and is held energized on segments 35 to 48, inclusive. This provides six additional impulses making a total of twenty-three.

The apparatus above described, therefore, provides a means for sending trains of impulses suitable for the operation of selectors of the type above-mentioned, the selectors operating to step a movable contact one step toward a fixed contact on each impulse of opposite polarity to the one preceding. By operating switches 76 and 77 to required predetermined positions, the impulses will be divided into three series with pauses between each series, the settings of switches 76 and 77 determining the number of impulses in each series and where the pauses between the first and second series and between the second and third series are to occur. The switch 78 provides for setting the apparatus to send additional impulses in the last series. By operating only two switches, namely switches 76 and 77, the train of impulses divided into three series is obtained. By operating switch 78 additional impulses are obtained in the last series.

The apparatus is shown and described as having a spring type motor for driving the brush contact of the commutator type switch 79. It is not necessary, however, to have a spring type motor for this purpose since other types of motors could be used in place of the spring type. There is some advantage, however, in having the motor a spring type device since operation of the apparatus does not depend on the maintenance of a source of current supply to the motor. Another advantage is that reduction in the cost of the apparatus to a user is obtained when the user already has selector keys of the type described in Patent 1,306,054 since a selector key of this type may be used as the driving motor for the brush contact 92 of the commutator type switch 79. A comparatively large number of railway companies already have selector keys of the type above mentioned and since selector keys of this type may be used as the driving motor simply by attaching the brush contact supporting arm 90 to the key, the cost of a new motor is saved by the purchaser of the apparatus.

What is claimed is:

1. A variable impulse transmitter for transmitting variable codes of impulses each code 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 in combination, a commutator comprising spaced segmental contacts and a wiper contact successively engaging said segmental contacts, a manually operated switch comprising paired fixed

contacts with the contacts in each pair spaced apart, movable contacts operating in the spaces between the paired contacts to selectively bridge said paired contacts, singly arranged fixed contacts, a single wiper contact to selectively engage said singly arranged contacts, means common to said movable contacts and said single wiper contact for moving such contacts, a second manually operated switch of like structure to that above described and circuit connections between the fixed contacts of said switches and the segmental contacts of said commutator to make certain of said segmental contacts normally live and other of said segmental contacts normally dead, the circuit connections being such that normally there is a group of segmental contacts in which alternate contacts in the group are live and the remaining ones in the group are dead and so that the segmental contacts preceding said group are normally dead and the segmental contacts following said group comprise a group of normally live contacts and a following group of permanently dead contacts and said switches being operable to selectively make the live segmental contacts dead and the dead segmental contacts live.

2. A variable impulse transmitter for transmitting variable codes of impulses each code 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 in combination, two rotary type switches the first switch designating the number of impulses in the first series and the second switch designating the number of impulses in the third series, each of said switches comprising paired series of spaced fixed contacts, movable contacts operating between said fixed contacts and selectively bridging said paired series, single series spaced fixed contacts, a wiper contact to selectively engage the fixed contacts in said single series, and means common to said movable contacts and said wiper contact for simultaneously moving the same, a commutator comprising a series of segmental fixed contacts, a wiper contact to successively engage said segmental contacts and means to drive said last-mentioned wiper contact into

successive engagement with said segmental contacts, conductor wires electrically connecting the fixed contacts in said rotary switches to corresponding segmental contacts in said commutator, whereby alternate ones of said segmental contacts therebetween are normally dead, and segmental contacts preceding the alternated live and dead segmental contacts are normally dead, and said rotary switches operating to selectively change said segmental contacts from a live condition to a dead condition.

3. In a variable impulse transmitter, for transmitting variable codes of impulses, each code 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, a commutator comprising a series of segmental fixed contacts, a wiper contact to successively engage said segmental contacts, and means to drive said wiper contact into successive engagement with said segmental contacts, two rotary type switches, each of said switches comprising three double sets of spaced fixed contacts arranged in three pairs, three sets of movable contacts, one set for each pair, arranged to selectively bridge the fixed contacts in said double sets, three single sets of spaced fixed contacts, three movable contacts, one for each of said single sets and arranged to selectively engage the fixed contacts in said single sets, means common to said three sets of movable contacts and said three movable contacts, to simultaneously move said movable contacts relative to said sets of fixed contacts and conductor wires extending from said fixed contacts in said switches to said segmental contacts so that alternate segmental contacts in said commutator are normally live and the segmental contacts alternated therewith are normally dead, the first of said switches designating the number of impulses in the first series, the second switch designating the number of impulses in the third series, and the number of impulses in the second series being automatically determined by the segmental contacts unaffected by the setting of the two switches.

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