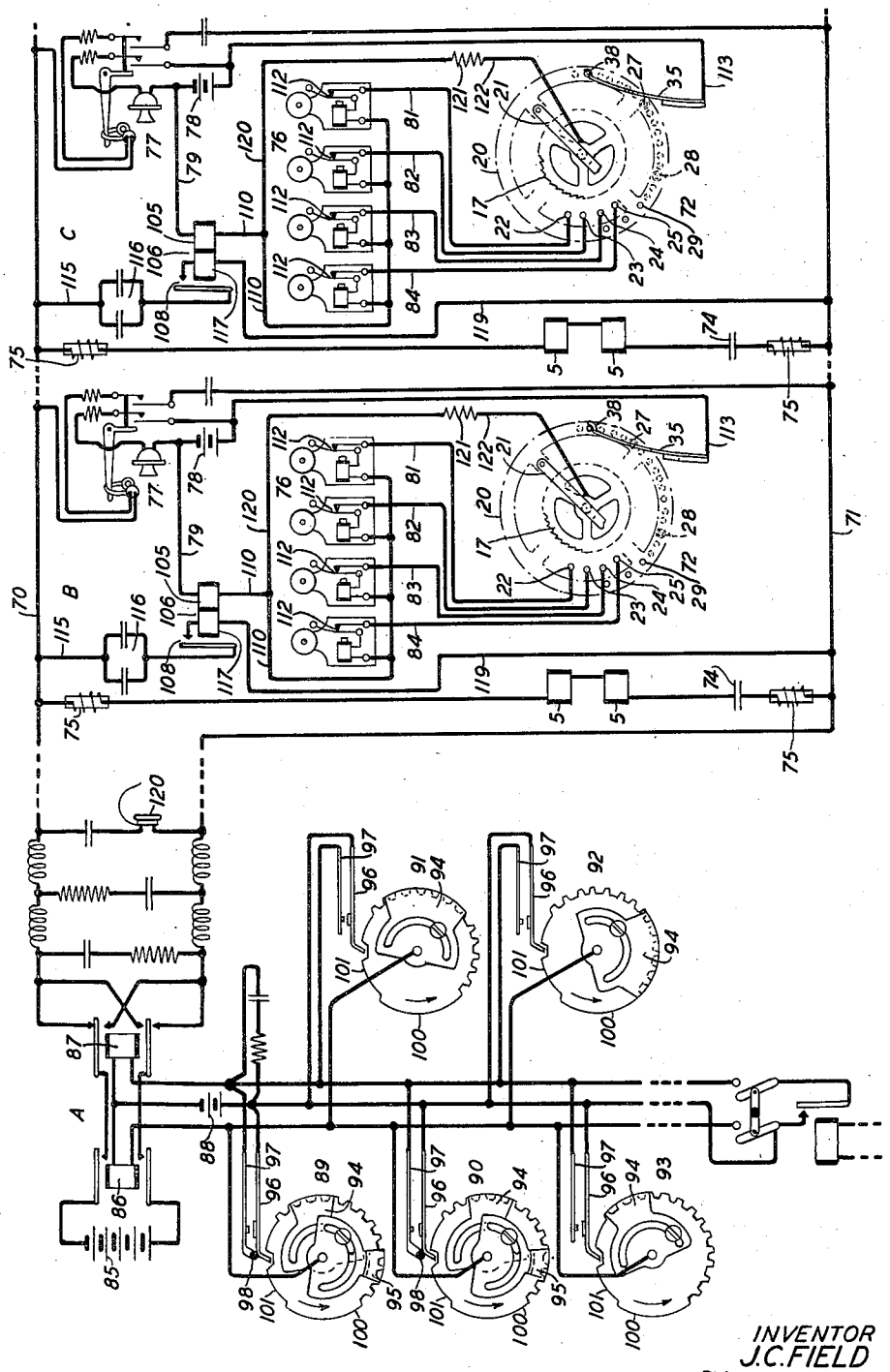
Jan. 25, 1938. J. C. FIELD 2,106,498

SELECTIVE SIGNAL SYSTEM

Filed March 11, 1936



INVENTOR
J.C.FIELD
BY
J. MacDonald
ATTORNEY

Patented Jan. 25, 1938

2,106,498

UNITED STATES PATENT OFFICE

2,106,498

SELECTIVE SIGNAL SYSTEM

Joseph C. Field, Maplewood, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application March 11, 1936, Serial No. 68,232

2 Claims. (Cl. 177—342)

This invention relates to signaling systems and more particularly to signaling systems provided with answer-back signaling means.

The object of this invention is to provide answer-back signaling means comparatively low in cost and which may be used in combination with a selective signaling system.

A feature of this invention resides in means provided for establishing an inductive coupling between a local circuit, including signaling devices, and the line circuit of a signaling system.

Other features residing in the particular form and arrangement of the parts in the circuit will be subsequently pointed out in the specification.

The invention may be used in connection with a selective signaling system of the type in which selectors at way stations are operated under the control of sending apparatus at a central station. The drawing shows the invention applied to a system of the type above mentioned and embodying apparatus fully described in Patent 1,343,256 of June 15, 1920, to which reference may be had for a full detailed description of the way station apparatus disclosed in this application, while the sending key apparatus disclosed is fully described in Patent 1,306,054 of June 20, 1919.

The drawing discloses a selective signaling system to which may be connected a large number of way stations, at each of which is a selector selectively responsive to a definite combination of code impulses, but for convenience of illustration only two way stations are shown.

In the drawing, 70 and 71 designate line wires extending from a central transmitting or dispatcher's station A to a plurality of receiving or way stations B and C. At each way station is a selector designated generally as 72, the energizing windings 5, 5 of which are connected in bridge of the line wires and in series with a condenser 74 and two impedance coils 75, 75. Each way station is also equipped with a plurality of signal bells 76 under control of the selector thereat and a telephone set 77 included in a normally open bridge of the line wires. A single battery 78 at each way station may serve for operating any one of the signal bells 76 and for furnishing current to the telephone set for talking purposes.

At the transmitting station A there is a main battery 85 for supplying current for operating the selectors at the way stations. This battery is normally disconnected from the line wires and may be connected therewith by the operation of a relay 86. A pole-changing relay 87 is provided for reversing the connections from battery 85 to the line wires. The relays 86 and 87 are connected in parallel and in circuit with the local battery 88 and are controlled by the impulse transmitters 89, 90, 91, 92 and 93. These transmitters may be variously adjusted for selectively operating individually or collectively the several selectors connected with the line or to operate a single selector for selectively closing any one of a plurality of contacts corresponding to any one of the signal bells 76 associated with the particular selector. These transmitters, as clearly described in Patent 1,306,054 are provided with teeth, certain ones of which may be blocked out by one or both adjustable cams 94 and 95 to obtain a particular number and combination of effective teeth for calling purposes. Each transmitter is adapted to rotate in the direction of the arrow and the teeth thereon are provided to throw contact springs 96 and 97 in circuit with the pole-changing relay 87. The free end of contact springs 97 of transmitters 89 and 90 is bent downward and carries at the extreme end thereof an insulating roller 98 which as the transmitter rotates is adapted to ride on top of the cam 95 and separate contacts 96 and 97 during the time of the passage of cam 95. Assuming that transmitter 89 is operated, it will be noted that as the disc thereof starts to rotate the circuit of relay 86 is completed, operating the relay and connecting battery 85 to the line wires. As contact spring 96 rides upon the first tooth, it also engages spring 97 to actuate the pole-changing relay 87 by current from battery 88, thereby reversing the connection of battery 85 to the line wires. When the spring 96 drops between two adjacent teeth, relay 87 will be deenergized and during the time spring 96 is passing over the cam 94, relay 87 will be energized to furnish a prolonged impulse of one polarity, for example, negative. As the disc continues to rotate, alternating impulses are sent over the line and when the cam 95 is reached, the insulating roller 98 on the spring 97 rides thereon and raises spring 97 to keep it out of reach of spring 96 so that during the time that the insulating roller 98 is riding over cam 95 a prolonged impulse of opposite or positive polarity is sent over the line wires. As the disc continues to rotate, additional alternating impulses are sent out over the line wires and when the spring 96 rides on the cam surface 100 a prolonged impulse is sent over the line wires to provide a ringing period. When the spring 96 drops on the cam surface 101 a prolonged positive impulse is sent over the line wires to release the selector at the selected station. When spring 96 is out of engagement with the

toothed wheel, relay 86 is released and battery 85 is disconnected from the line.

Now assume that the selector at way station B is arranged to respond to a code of impulses represented by 3—9—3 to close the local circuit for the first bell of the series 76. When the transmitter 89 is operated, it will first complete a circuit for relay 86 to connect battery 85 to the lines 70 and 71. The circuit is completed by the engagement of the toothed wheel with the spring 96. When the battery 85 is brought into connection with the line wires 70 and 71 an impulse of current flows to the selectors 72 at the way stations. The selectors, therefore, move one step but since the contacting portion of the toothed wheel, preceding the first tooth, is comparatively long the selectors restore to normal position again. The toothed wheel continues to rotate and then alternately closes, opens and closes, through springs 96 and 97, the circuit of relay 87. Since relay 87 operates as a pole changer for the battery 85 three impulses of opposite polarity are sent to the selectors at the way stations. The third impulse by reason of the length of the cam 94 is of sufficient duration to permit the magnets of all selectors on the line to release before the first impulse of the second set is sent. It should be understood that when potential of either polarity is applied to the line for a sufficient interval the condensers 74, 74 become charged whereupon the flow of current through the selector magnets ceases and the selector magnets release. Those selectors, including the wanted station B, arranged to respond to codes of impulses the first set of which is made up of 3, will, in releasing, cause the curved end 38 of the contact springs 35 to engage the holding pin 27 in the contact carrying member 20, so that the contact carrying members 20 at these particular stations will be held in advanced position. All other selectors on the line, including the one at station C, requiring a different number of current impulses to bring their pins 27 into engagement with the curved end 38 of spring 35 will be dropped back to normal position. Nine impulses will next be transmitted over the line to step the ratchet wheel 17 around to a position where, when the selector magnets are deenergized, due to the extended duration of the ninth impulse, curved end 38 of spring 35 will engage the pin 28 at station B, thus holding the selector at that station in advanced position, while the selector at station C will return to normal position. The selectors at all stations connected to the line, which are arranged to hold in response to a code of impulses, the sum of the impulses of the first two sets of which total nine, and those arranged to hold in response to a code of impulses, the first set of which is of nine impulses, will also be held in advanced position, while all other selectors, which were held in advanced position at the end of the first set of impulses transmitted, will be returned to normal position. Three impulses now sent over the line circuit will cause the engagement of contact 21 with the contact 22 at station B, and the engagement of curved end 38 of spring 35 with holding pin 29. The stopping of contact 21 on contact 22 closes an energizing circuit through the energizing winding 105 of a relay 106, the operation of which closes contacts 108 on the relay 106.

Relay 106 has two windings on the same core, one of them being the relay winding 105 and the other being a winding 117 which is included in a normally open bridge across the line wires 70 and 71, the windings being inductively associated to form an inductive connection between the local circuit including the signal bells 76 at the way station and the line circuit leading to station A. When contact 21 of the selector 72 comes to rest on contact 22 and is retained thereon by reason of the holding of the contact carrying member 20 in advanced position by engagement of the curved end 38 with holding pin 29, relay 106 is energized over a circuit which may be traced from battery 78, conductor 79, energizing winding 105 of relay 106, conductor 110, break contacts 112 of bell signals 76, conductor 81, contact 22 of selector 72, contact 21, contact carrying member 20, holding pin 29, spring 35, conductor 113 to battery 78. The extreme right-hand bell of the signal bells 76 is operated over this circuit and intermittently breaks and closes the circuit through its break contacts 112. When relay 106 is energized it closes contacts 108 and connects the secondary winding 117 on relay 106 across the conductors 70 and 71 of the line circuit. The connection of secondary winding 117 across the line circuit may be traced from line wire 70, conductor 115, condensers 116, in parallel, contacts 108, secondary winding 117, conductor 119 to line wire 71.

Now, as the signal bell 76 vibrates in response to the current from battery 78 and intermittently opens and closes its energizing circuit the pulsations will pass through winding 105 of relay 106, thereby inducing current into winding 117 on the relay 106. The current pulsations induced in the winding 117 will pass over the line wires 70 and 71 to a receiver 120 in permanent bridge of the line wires 70 and 71 at the dispatcher's station A and these pulsations will generate a tone in the receiver 120 which will indicate the operation of the signal bell 76 at the selected way station.

To prevent relay 106 from being deenergized at each break of the break contacts 112 a holding circuit for relay 106 is provided. The holding circuit may be traced from battery 78, conductor 79, winding 105 of relay 106, conductor 110, conductor 120, resistance 121, conductor 122, contact carrying member 20, holding pin 29, spring 35, conductor 113 to battery 78. Resistance 121 is of sufficiently high value to make the current for energization of relay 106 normally pass over the circuit including the break contacts of the signal bells 76 but when the break contacts of the signal bells 76 are intermittently opened sufficient current will flow in the holding circuit to prevent deenergization of relay 106. This prevents chattering of the contacts 108 under all conditions of operation. The answer-back signals, therefore, are not changed or interfered with by contacts of the relay 106.

The windings 105 and 117 on the core of relay 106 are preferably arranged to produce a step-up transformer effect, the step-up being from the energizing winding 105 of the relay 106 to the inductively associated winding 117 which when contacts 108 are closed is bridged across the line wires 70 and 71.

The signal bells 76, obviously, may be located at various positions remote from each other and may serve as signal devices for stations served by the common selector 72, the selector operating to select a required station in accordance with the code signals sent from station A. Each bell is connected to a separate fixed contact on the selector 72 and may be separately brought into

operation by movement of the selector contact 21 to the required fixed contact. One terminal of the extreme right-hand signal bell 76 is connected by means of conductor 81 to the terminal 22 of the selector. The other terminal of this bell is connected to conductor 110 which is in the normal energizing circuit of relay 106. Conductor 110 is common to all of the signal bells 76 in the set. The bell next in line, to the extreme right-hand bell, is connected by means of conductor 82 to contact 23 of the selector 72. The next bell is connected by means of conductor 83 to contact 24. The left-hand bell is connected by means of conductor 84 to contact 25. By sending a required number of impulses from station A to the selector at the way station any one of the signal bells 76 may be selectively brought into operation.

Since the signal bells 76 are included in a local circuit which is normally open and which is not closed until the selector 72 has operated to a holding position where the spring 35 engages a holding pin and since the relay 106 does not operate to close contact 108 until the holding position has been reached by the selector and the selector has stopped in its selective operation there is no likelihood that a false signal will be given either at the way station or in the form of an answer-back tone to the station A. Also, a relay with the inductively associated windings as described provides a comparatively low cost inductive apparatus and also makes it possible to use comparatively low cost signal bells or buzzers in the local circuit.

When the selector 72 is operated to move the contact 21 to one of the fixed contacts beyond contact 22, that is, to contacts 23, 24 or 25, there is no operation of the bell signals 76 or closing of contacts 108 as the contact 21 passes across the preceding fixed contacts of the selector. The reasons for this are that these contacts are passed quite rapidly and the circuit for energizing the signal bells 76 and the relay 106 is not made by the engagement of the hooked end 38 of spring 35 with a holding pin on the contact carrying member 20 until the selector has stopped in its advance movement. When the selector stops advancing, a return spring in the selector moves the contact carrying member in reverse direction to a slight extent and spring 35 is moved so that the curved end 38 comes into the path of movement of the nearest holding pin. The spring 35 as explained in the above-identified patent covering the selector does not come to a rest position where the hooked end 38 will engage a holding pin until the electromagnets of the selector are deenergized.

What is claimed is:

1. A signaling system comprising in combination, a line circuit, a selector controlled over said line circuit, a local circuit controlled by said selector, a signaling device in said local circuit, said signaling device being of the self-interrupting type and having normally closed contacts in said local circuit operated by said signaling device, a relay having its operating winding in said local circuit, a normally open bridge across said line circuit, a winding in said normally open bridge, said winding being inductively associated with the operating winding of said relay, contacts in said normally open bridge, said contacts being controlled by said relay to establish an inductive connection between said local circuit and said line circuit, and a holding circuit for said relay comprising a resistance in shunt of said signaling device to hold said relay operated during the open periods of the contacts operated by said signaling device.

2. In a signaling system in combination, a line circuit, a selector connected to said line circuit, a local circuit, normally open branches in said local circuit, a signaling device of the self-interrupting type in each of said normally open branches, contacts in said normally open branches selectively closed by means of said selector, a relay having its operating winding in said local circuit and common to said normally open branches, said relay being energized when any one of said branches is closed, a normally open bridge across said line circuit and closed by means of said relay and a coil in said normally open bridge in inductive relation with the operating winding of said relay and forming an inductive connection between said local circuit and said line circuit when said normally open bridge is closed.

JOSEPH C. FIELD.