

May 3, 1938.

F. E. WELD

2,116,372

SIGNAL TRANSMITTER

Filed Sept. 21, 1933

4 Sheets-Sheet 1

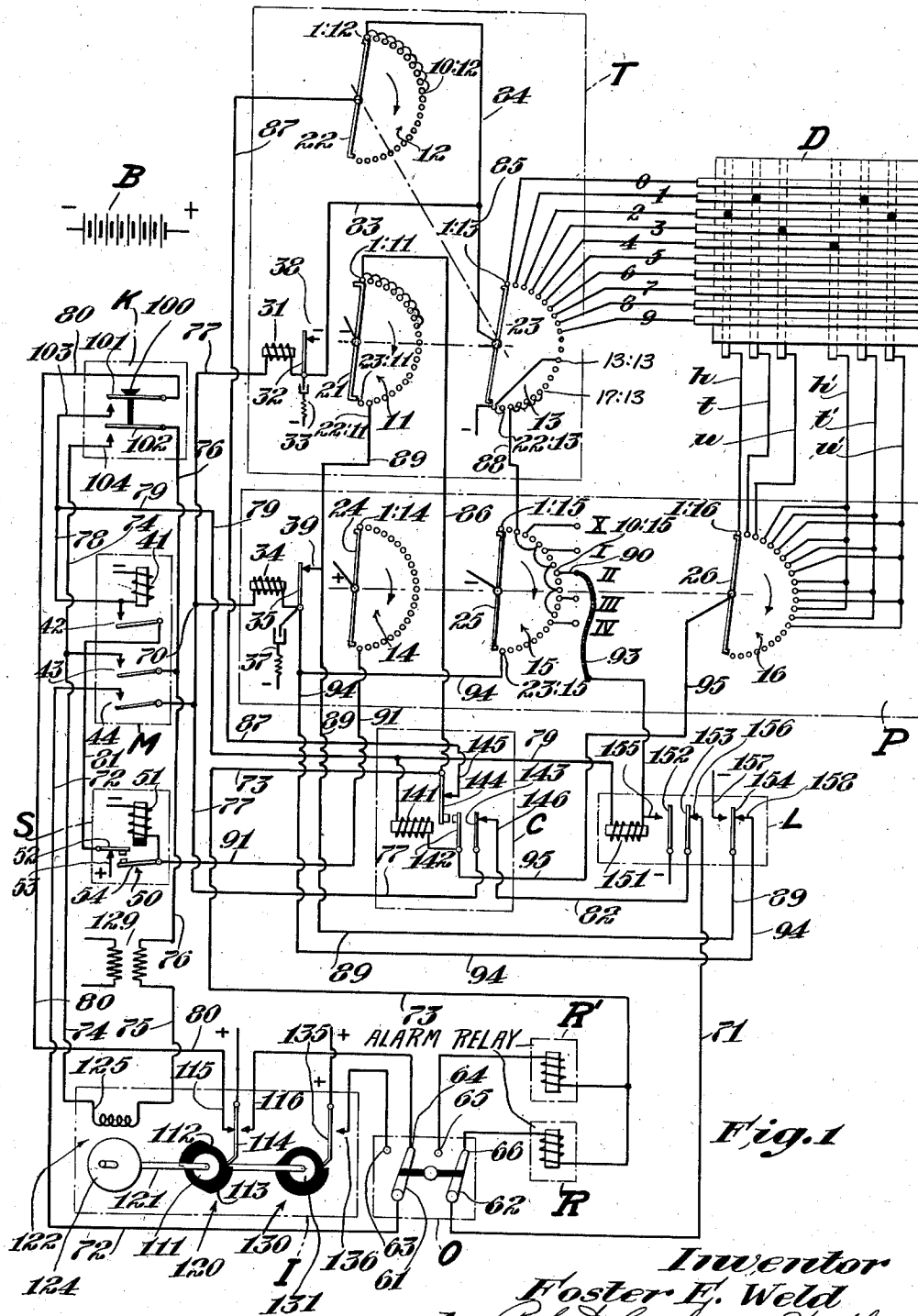


Fig. 1

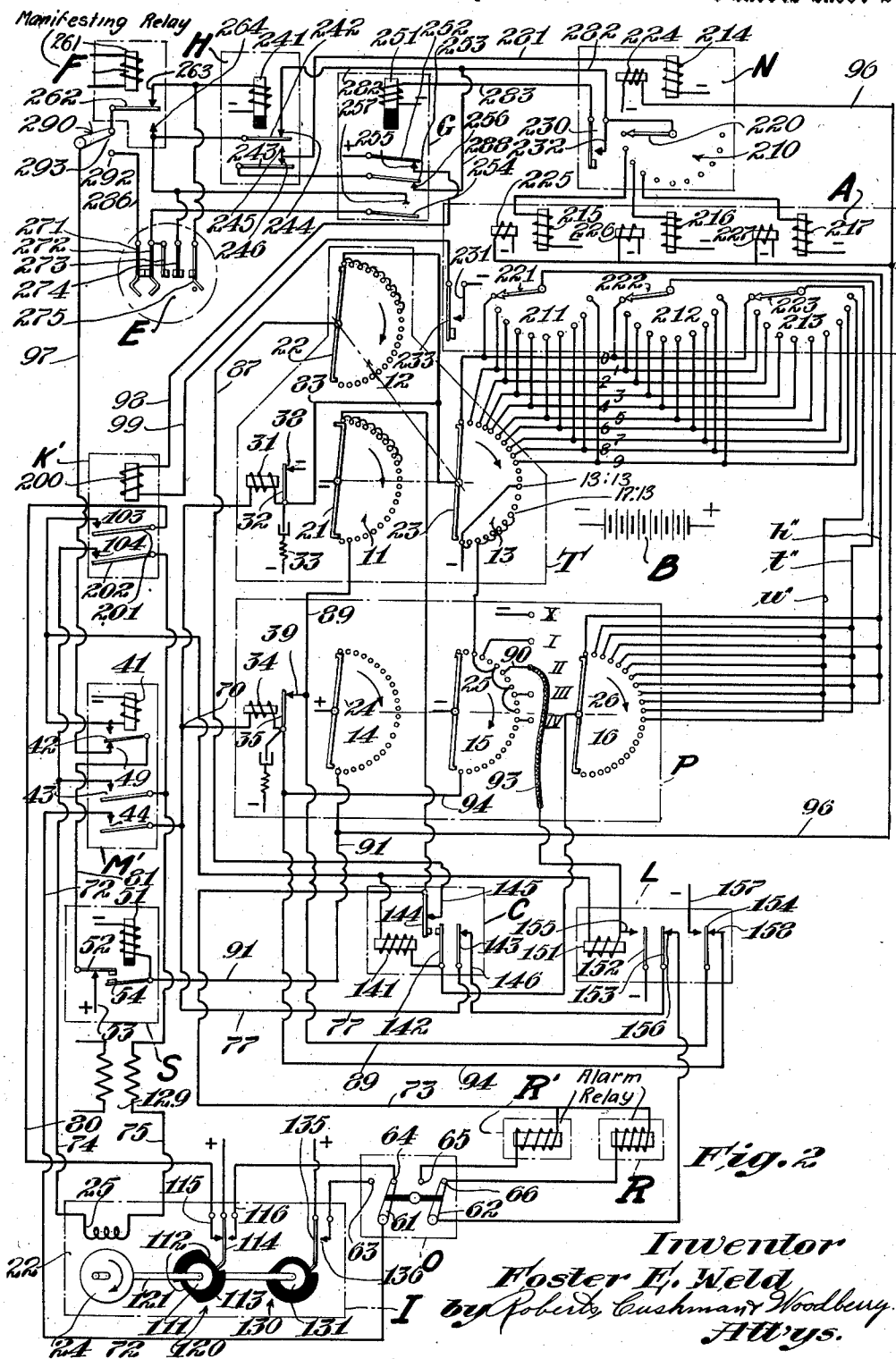
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SIGNAL TRANSMITTER

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4 Sheets-Sheet 2



May 3, 1938.

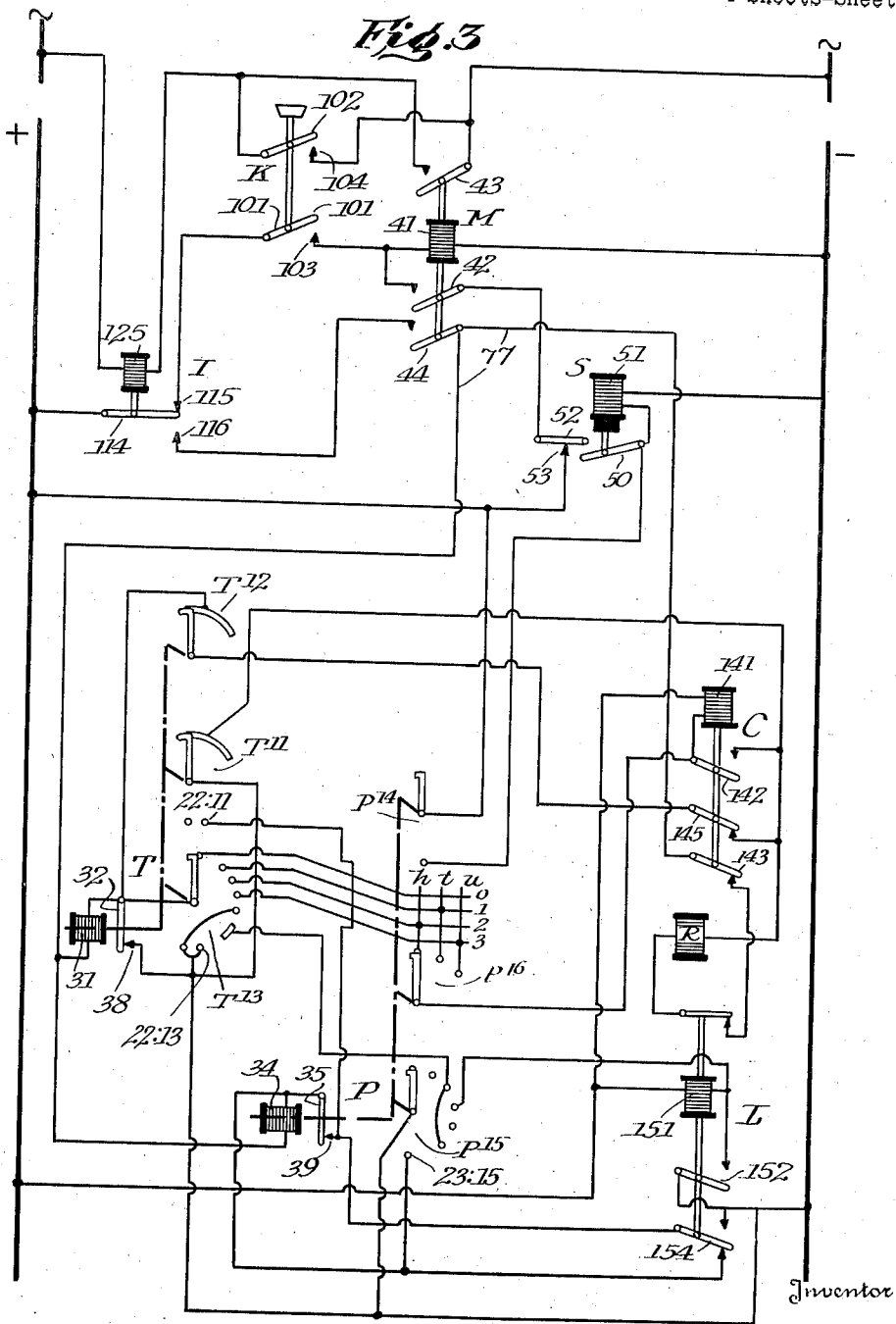
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Fig. 5.

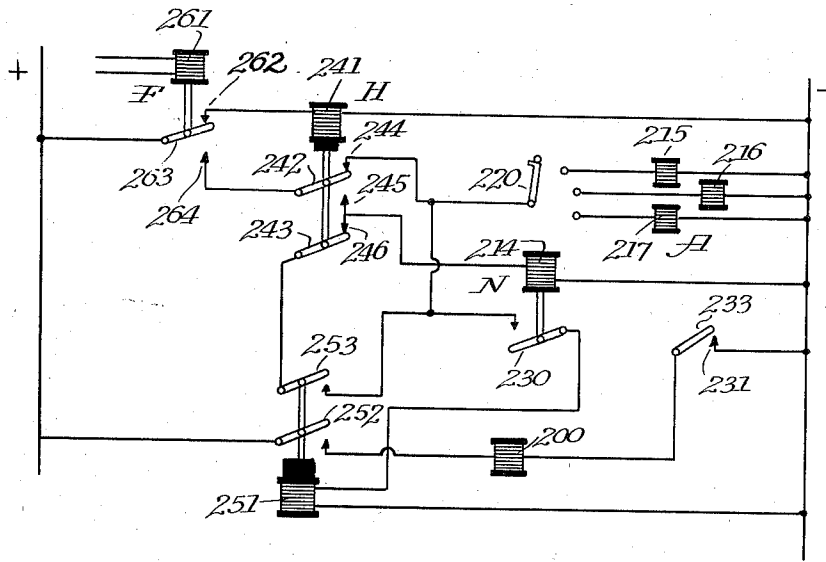


Fig. 4.



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UNITED STATES PATENT OFFICE

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SIGNAL TRANSMITTER

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Application September 21, 1933, Serial No. 690,408

12 Claims. (Cl. 177—380)

The present invention relates to devices for transmitting code signals of the type which are used in fire alarm systems and similar circuits. Such installations permit the sending of code numbers by consecutively energizing and de-energizing a circuit at certain intervals grouped with intervening pauses of varying length, and representing the digits of numbers of known significance. It is often desirable to distribute or repeat such code signals in the simplest possible manner.

For example, the telephone exchange of a community may be organized for transmitting in the form of code signals, alarm messages orally received from the subscribers over the ordinary telephone network. A person may discover a fire, thereupon call the exchange and report the occurrence to the operator, who immediately notifies the fire department of the alarm.

It is highly desirable to provide the telephone operator with means for transmitting the alarm in a manner that is customary in the fire fighting service, namely, as code number signals manifested as bell strokes and/or recorded on tape. Hence, the telephone operator may select, for example with the aid of charts or tables, the code signal standing for the locality from which the alarm was received and transmit this signal to the fire department.

It is therefore one of the principal objects of the present invention to provide apparatus for sending variable code number signals in the simplest possible manner, thereby reducing the operator's activity to a minimum and excluding to a very high degree the possibility of making errors in the transmission of the signals.

With the aid of the equipment according to this invention, the telephone operator, after receiving the call and selecting a number associated with the location of the fire, sets up this number and, if desired, an additional special number of a prearranged meaning, with the aid of a digit setting device, upon which he can visualize the number, presses a button and thereby initiates transmission of the number repeated any desired number of times. Or according to one embodiment of the invention, the telephone operator may dial the number once on a conventional telephone dial, whereupon the signal is transmitted a predetermined number of times to the fire authorities without any further activity by the operator. It is further feasible to connect the new apparatus to a conventional signal manifesting device and to repeat any one incoming code number as often as desired.

Accordingly, further objects of my invention are to provide means for setting up a code signal by manually establishing certain electric connections representing code numbers or by dialing such numbers with the aid of a conventional telephone dial switch; to provide means for subsequently transmitting the set up signals a desired number of times, the transmission being initiated automatically when the complete signal is set up, or by a simple manipulation as, for example, pressing a switch button; and to provide means for automatically storing code signals manifested in a conventional alarm or similar circuit and then transmitting these signals.

In another aspect, the invention contemplates a signal circuit connected with a device sending into the circuit current impulses at regular intervals and having instrumentalities which prevent the effectiveness of certain of those impulses, thereby forming signals according to a prearranged code.

In a further aspect, the invention provides an automatic signal storing and transmitting device which is comparatively simple and reliable, due to the utilization of conventional telephone selector switches.

These and other objects and aspects of the invention will be apparent from the following detailed explanation illustrating the genus of the invention with reference to several concrete embodiments thereof. The description refers to drawings in which—

Fig. 1 is a circuit diagram of a variable signal sender with manual digit setting device and independent starting device;

Fig. 2 is a circuit diagram of a variable signal sender including means for automatically storing and retransmitting a signal received either from a signal manifesting device or a telephone dial;

Fig. 3 is a simplified straight line diagram incorporating part of the circuit according to Fig. 1;

Fig. 4 is the diagrammatic representation of a signal stored and transmitted with apparatus according to Fig. 2; and

Fig. 5 is a simplified diagram similar to Fig. 3, of part of the automatic digit setting device incorporated in the modification according to Fig. 2.

The circuit which is diagrammatically shown in Fig. 1 comprises battery B, starting key K, impulse sender I, maintenance relay M, stopping relay S, alarm relays R, R', change-over switch O, control relay C, limiting relay L, transmitting

switch T, sequence or pause switch P, digit setting device D, and the electrical connections intermediate these elements which will now be described in detail.

5 A suitable source of power, herein indicated as battery B, supplies the system with current. In order to simplify the circuit diagrams, the individual connections with the power source have not been shown in Figs. 1 and 2, but the
10 points of the circuit which are supplied with current have been indicated by appropriate polarity signs, these points being assumed to be in conducting connection with the respective poles of the battery.

15 The starting key K consists of two resilient switch members 101 and 102 separated by an insulating block 100 and preferably designed as a push button switch permitting simultaneous actuation of members 101 and 102 which cooperate with contacts 103 and 104, respectively.
20 The respective members contact upon pressing the button, and connection is interrupted when the push button is released. It is understood that these contacts or similar organs may be operated in a different manner, for example, by means of a magnet, as shown in the modification according to Fig. 2.

The impulse sender I has the purpose of supplying the system according to the invention at regular intervals with current impulses. Any arrangement adapted to this purpose may be used, but in the herein-described embodiment I employ rotating impulse switches 120 and 130.
25 Switch 120 comprises a cam disk 111 of insulating material, with raised portions 113 and lower portions 112. The cam disk actuates a follower switch 114 which rests against a starting contact 115 if sliding on the lower cam portions 112, but leaves 115 and connects with an impulse contact 116 when raised by cam portions 113.

30 Disk 111 is fastened to shaft 121, driven by motor 122 herein assumed to be a self-starting synchronous motor with rotor 124 and stator 125. A second impulse switch 130 is quite similarly constructed and has a disk 131 also keyed to shaft 121, disk 131 being similar to disk 111 with the difference that it has only one raised cam portion. It cooperates with contacts 135 and 136 corresponding to members 114, 116, respectively, in the manner described above for these members. Switch 130 supplies the system with current impulses at one-half the frequency of the impulses provided by switch 120, as will be apparent without further explanation.
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40 The maintenance relay M consists in substance in a maintenance magnet 41 controlling normally open switches 42, 43, 44, respectively, which close upon energization of magnet 41.

45 Stopping relay S comprises a stopping magnet 51 and a three-contact stopping switch 50 of the make-before-break type. Normally, movable contact 52 connects with fixed contact 53 which is joined to the positive pole of battery B. Magnet 51 is of the retarded release type, being, for example, equipped with a copper sleeve of well known retarding effect and, if energized, attracts armature contact 54 which reaches movable contact 52 before it lifts the latter from fixed contact 53.
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55 The alarm relays R and R' are representative of devices suitable to transmit signal impulses to conventional signal manifesting apparatus or circuits, as registers, signal bells or repeater circuits as commonly used in fire alarm systems. In
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the present instance, it may be assumed that the magnets of relays R, R' are normally energized, and upon deenergization cause manifestation of one signal element, for example, the stroke of a bell.

Alarm relays R and R' can be selectively connected either to the slow running impulse switch 130 or the fast running impulse switch 120, respectively, by means of change-over switch O, comprising movable contacts 61, 62 and fixed contacts 63, 64, 65, 66, which are connected to contacts 136, 116, and relays R, R', respectively. In the position shown in Fig. 1, contacts 61, 62 connect the quick acting impulse switch 120 to relay R. By shifting members 61, 62 to contacts 63, 65, slow acting impulse switch 130 can be connected to relay R'.
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Switch member 62 is connected to limiting relay L through lead 71, and member 61 is connected through lead 72 to the fixed contact of switch 44 of maintenance relay M. The terminals of relays R, R' which are not connected to contacts 65, 66, respectively, are joined, and connected through lead 73 to control relay C.
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The stator 125 of motor 122 is supplied from a suitable source of current, in the present embodiment alternating current derived from a transformer 129, by means of leads 74, 75 and 76. Wire 74 is connected intermediate stator 125 and starting key contact 104. Wire 76 joins transformer 129 and starting key member 102. Lead 75 connects the other terminal of transformer 129 to stator 125. Wires 74 and 76 can be directly connected through normally open switch 43 of maintenance relay M, switch 43 being in parallel with switch 102—104 of starting key K.
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The aforementioned wire 72 leading from contact 61 of change-over switch O to switch 44 of relay M can be connected by means of switch 44 of maintenance relay M to lead 77, which will herein be referred to as impulse wire. Contact 115 of impulse switch 120 is connected through lead 80 to switch member 101 of starting key K. The corresponding fixed contact 103 is connected through wire 78 to magnet 41 of maintenance relay M, whose holding circuit including switch 42 has been described above. Lead 78 is further branched into wire 79 leading to relays C and L.
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It will now be apparent that, when the starting button is pressed, switch 101—103 connects the motor circuit and starts motor 122 and that switch 102—104 sets up the following circuit. If follower switch 114 of impulse sender I happens to be in the lower position as shown, or as soon as it arrives in that position (the motor being already started), it connects starting contact 115 and lead 80 with the positive pole of the battery, and through switch 101—103, lead 78 and magnet 41 connects with the negative pole, thereby energizing maintenance magnet 41. Magnet 41 immediately closes its switches and remains in that position after the starting key is released, due to the holding circuit established through switch 42, from positive at fixed contact 53 of stopping relay S through 52, lead 81, switch 42, magnet 41 to negative. This holding circuit remains closed, and magnet 41 energized, as long as contact 52 of stopping relay S is connected with the positive pole. Switch 43 similarly maintains connection between motor leads 74 and 76, so that the motor remains energized regardless of the position of the starting key. Likewise, switch 44 remains closed as long as magnet 41 is energized and maintains a circuit from the impulse sender I
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through change-over switch O and lead 72 to impulse wire 77.

The control relay C consists of a magnet 141, two armature contacts 142 and 143, spring contact 144 and two fixed contacts 145 and 146. Contact 143 is connected to the aforementioned wire 77, contact 142 is connected to one terminal of magnet 141 (whose other terminal is joined to lead 79), and contact 144 is connected to leads 73 and 86. In normal position, as shown in Fig. 1, when magnet 141 is deenergized, contacts 144, 145 and 143, 146, respectively, are connected, whereas contacts 142 and 144 are separated. Upon energization of magnet 141, armature contacts 142 and 143 are attracted and contact at 143—146 is interrupted. Member 142 establishes effective connection with spring contact 144, before it removes the latter from fixed contact 145, so that connection is established at 144 before contact is broken at 145.

The limiting relay L consists of a magnet 151 which controls three armature contacts 152, 153, 154 associated with four fixed contacts 155, 156 and 157, 158, respectively. Under normal conditions, as shown, when magnet 151 is deenergized, contact pair 152, 155 is separated, contact pair 153, 156 is connected and armature contact 154 which cooperates as change-over element with fixed contacts 157, 158, rests against contact 158. Upon energization of magnet 151, contact is established at 152—155, contact is broken at 153—156, and switch 154 changes from contact 158 to contact 157.

One terminal of magnet 151 is connected to lead 79 and the corresponding terminal of magnet 141 of control relay C. The other terminal of magnet 151 is connected to fixed contact 155. Armature contact 152 and fixed contact 157 are on the negative pole of the battery. Armature switch 153 is joined by lead 82 to fixed contact 146 of control relay C. Fixed contact 156 connects with change-over switch O through the aforementioned lead 71.

Transmitting switch T and pause switch P are telephone selector switches of the well known type which consecutively connect a number of contacts step by step with a common terminal. The function of the transmitting switch T is to count the number of strokes in each digit while that of the pause switch P is to cause the digits of a signal to be transmitted in proper sequence and with proper pause intervals between each digit. These switches are, therefore, also referred to as "impulse counting switch" and "sequence switch", respectively. Referring more particularly to transmitting switch T, this mechanism comprises three selector units 11, 12 and 13, each having a series of selector contacts, and wipers 21, 22, 23, respectively, the three wipers being mechanically connected to move in unison. In order to simplify drawings and description, the selector contacts are herein designated by their position within the selector unit, combined with the selector unit numeral, both numerals being separated by a colon, so that, for example, the tenth contact of selector switch 12 will be referred to as contact 10:12.

The wipers normally contact with the first selector contacts of the respective unit and are advanced by means of an actuator magnet 31 operating a stepping switch 32 which contacts with actuator contact 38, connected to the negative pole of the battery, if magnet 31 is deenergized. The magnet and its armature, that is, stepping switch 32, are so organized that the three wipers

of the transmitting switch are advanced one single step, from one contact to the adjacent one, upon each deenergization of the actuator magnet. Such selector switches are well known in the telephone art and need not be described more in detail. It should, however, be observed that wiper 21 should be of the make-before-break type. For example, it may have sliding contacts or brushes sufficiently wide to touch the next contact before they leave the preceding one. Recapitulating the operation of this switch, it remains at rest so long as magnet 31 is energized, under which condition stepping switch 32 is separated from fixed contact 38. Upon deenergization of the magnet, stepper 32 is retracted therefrom by suitable means, advances wipers 21, 22, 23 one step and contacts with fixed contact 38. If lead 83 is disconnected from the energy supply, 31 is again energized, 32 attracted, and so on, stepper 32 vibrating and advancing the wipers quickly (preferably within one impulse of 120 or 130) over the selector contacts. If, however, lead 83 is connected to negative, stepper 32 remains attracted to magnet 31 as long as the latter is energized, regardless of the interruptions at 38. The wipers rest normally upon the first contacts of their respective selector units, as shown in the drawings.

Pause switch P is constructed similar to transmitting switch T, having three selector units 14, 15, 16 with wipers 24, 25, 26, respectively, and corresponding rows of selector contacts which will be identified by double numbers like the selector contacts of switch T. Actuator magnet 34, stepping switch 35 with fixed contact 39 (connected to lead 89), and the wipers 24, 25, 26, operate in the same manner as the corresponding elements of the transmitting switch. Like the wipers of switch T, the members 24, 25, and 26 rest initially at the respective first selector contacts. Both switches have conventional spark suppression arrangements 33 and 37, respectively, bridging contacts 32, 38 and 35, 39, respectively. Contacts 39 and 35 are normally bridged through leads 89 and 94 and contacts 154—158 of limiting relay L.

The digit setting device D may consist of any instrumentality for selectively connecting a series of conductors (in the present instance number busses 0 to 9) with a second series of conductors (in this embodiment digit busses *h*, *t*, *u*; *h'*, *t'*, *u'*). This might be accomplished, for example, by connecting a flexible wire ending in a plug to each digit bus and by providing each number bus with as many plug receptacles as digit busses are used. Each digit bus could then be plugged into any of the number busses. Or, the two bus series can be arranged on two sides of an insulation panel and holes drilled through busses and panel at each crossing of the former. Metal plugs can then be inserted at any crossing for establishing contact between any pair of number and digit busses. In Fig. 1, an arrangement of the latter type is diagrammatically shown, the plug connections being indicated with full dots. In the present instance, it is assumed that a special number group consisting of a current impulse series arranged to represent a number with three digits, namely hundreds, tens and units, should be transmitted, followed by similarly constituted signals representing a box number. Accordingly, there are ten number busses 0 to 9, three special signal digit busses *h*, *t*, *u*, and three box number digit busses *h'*, *t'*, *u'*. If it is, for example, intended to set up and to transmit a

signal consisting of special signal "213" and box number "412", the number and digit busses are connected as indicated in Fig. 1. In this manner, it is possible to set up any code signal for automatic transmission consisting of impulses representing a pair of number groups, each group comprising three digits. It will, however, become evident from the following description that the arrangement herein described can be easily supplemented to adapt it for transmission of numbers with more than three digits, and for transmission of more than two different numbers. It will also be apparent that the apparatus may be simplified by providing for a single number, when only three digit busses are required.

As shown in Fig. 1, one terminal of each actuating magnet 31 and 34, respectively, is connected to the aforementioned lead 77, whereas the two other terminals of these magnets are connected to the respective stepping switches. The stepping switch 32 of selector T is connected through wires 83 and 85 to wiper 23 of selector switch 13 and through wires 83, 84 to contact 1:12, which is part of a group of electrically interconnected contacts, as shown in Fig. 1. Contacts 1:11 to 10:11 of selector switch 11 are similarly interconnected and electrically joined to armature switch 144 of control relay C, by means of lead 86. Contact 22:11 is connected, through lead 89, to stationary contact 39 of switch P and to armature switch member 154 of limiting relay L. Wiper 21 of selector switch 11 is electrically linked to the negative pole of the battery, and wiper 22 of selector switch 12 is connected through lead 87 to fixed contact 145 of control relay C. Contacts 1:13 to 10:13 lead to number busses 0 to 9, respectively. Contacts 17:13 to 21:13 are interconnected and joined to contact 3:15 of relay P, by means of lead 88. Contacts 22:13 and 23:13 are interconnected and joined to the negative pole of the battery.

The wiper 24 of selector unit 14 (switch P) is supplied from the positive pole of the battery. The contact 23:14 of the same unit is connected through lead 91 to armature contact 54 of stopping relay S and with it to one terminal of magnet 51, whose other terminal is connected to the negative terminal of the battery.

The wiper 25 of selector switch 15 is supplied from the negative pole of the battery. The contacts of this selector switch are in the present example interconnected as follows: 3:15 to 6:15, 9:15, 12:15 and 15:15, always omitting two contacts. Contact 3:15 is further connected through lead 88 to contact 21:13, as heretofore mentioned. Contacts 4:15, 7:15, 10:15, 13:15 and 16:15 are brought out to points X, I, II, III and IV, which may be, for example, receptacles for receiving a plug contact fastened to a flexible wire 93 leading to fixed contact 155 of limiting relay L and to its magnet 151. In this manner, these elements of relay L can be selectively connected to any one of contacts 4:15, 7:15, 10:15, 13:15 and 16:15. Contact 23:15 is connected through lead 94 to stepping switch 35 of switch P and also to fixed contact 158 of limit relay L.

The wiper 26 of selector switch 16 is connected through wire 95 to armature switch 142 of control relay C and that terminal of magnet 141 which is joined to said switch. The contacts of selector unit 16 are associated with the digit busses as follows: Contacts 1:16, 2:16 and 3:16 are connected to busses h, t, u, respectively, whereas every fourth of the remaining contacts is connected to the same bus h', t', u', respectively,

that is, 4:16, 7:16, 10:16, etc., are connected to h'; 5:16, 8:16, 11:16, etc., are connected to t', etc. As mentioned before, the present embodiment of the invention provides for the transmission of code signals comprising manifestations arranged in code series representing two different number groups of three digits, each digit being made up of the appropriate number of individual strokes or other impulses. In the present instance, it is possible to transmit first a number group representing a "special signal" and subsequently a number group representing a "box number", which box number can be repeated from one to four times.

The circuit of Fig. 1 is set up for transmission of the signal "213, 412, 412", by connecting number and digit busses, as above described, and by connecting wire 93 through plug 90 and receptacle II to contact 10:15, which set up provides for transmission of the above signal, the box number being repeated two times, as will become apparent from the following description of the operation of the new system. In describing the operation of the system according to Fig. 1, it is also assumed that it is desired to send signals at fast speed, switch O being in the position shown.

In order to transmit the signal selected in this manner, it is only necessary to press the push button 100 of starting key K, thereby connecting contacts 101, 103 and 102, 104, respectively. The closing of the latter contacts establishes, through leads 74 and 76, a motor supply circuit—from the secondary of transformer 129 through 75—125—74—104—102—76 back to 129. Upon being supplied with energy, motor 122 begins to run at its prescribed speed, and impulse switch 120 of impulse sender I connects contacts 114 and 115 during, say, the first and third quarter of each revolution of shaft 121, and contacts 114 and 116 during the second and fourth quarter. Member 101 of starting key K is depressed together with 102 until it reaches contact 103. At this time, follower switch 114 is either in the position shown, contacting with 115, or will soon be in that position, since motor 122 is started at the same time and changes the position of the follower even if the starting key 100 is released after a comparatively short time. Connection being established at 101—103 and 114—115, a circuit from minus pole through magnet 41 of maintenance relay M—lead 78—103—101—lead 80—contact 115—follower switch 114 to plus pole is closed and magnet 41 energized. Magnet 41 attracts its armature members and closes switches 42, 43, 44, thereby establishing the following circuits. A holding circuit for magnet 41 is closed from minus through 41—42—81—52—53 to plus. A motor holding circuit is closed from transformer 129 through 76—43—74—125—75 back to 129. These two holding circuits are established immediately when the starting key is operated, and the latter can now be released without causing any change in the condition of the circuits as established at this time. That is, magnet 41 remains energized and motor 122 continues to run regardless of the position of members 101 and 102 of the starting key and of the position of follower 114. Magnet 41 also closes, and retains closed impulse switch 44 which establishes, during each of the two periods of each revolution of disk 111 when follower 114 touches contact 116, connection from positive through follower 114—116—64—61 of change-over switch O—72—44—to impulse wire 77. This connection is in-

interrupted during the two intervening quarter revolutions as will now be evident.

The explanation of the operation of the new device will perhaps be easier comprehended by consulting the "straight line diagram" of Fig. 3, wherein the magnets and contacts are separated in such a manner as to render the tracing of the various circuits comparatively simple. In order to permit convenient reference to Fig. 1, the numerals of certain circuit elements are in Fig. 3 preceded by the letter of their respective circuit component. For example, contact 145 of control relay C is in Fig. 3 designated by the symbol C 145, and magnet 141 of the same relay by C 141, indicating that both elements are parts of relay C. It should also be remembered that impulse wire 77 with branching point 70 is connected to positive whenever follower 114 contacts with 116, and hereinafter the circuits including the impulse wire need only be traced to point 70 instead of to positive through contact 114.

Assuming now that point 70 has just become positive (upon 114 contacting with 116), actuator magnet 31 of transmitting or impulse counting switch T is energized through stepping switch 32 which normally connects to minus. Switch 32 is thereupon attracted and, as described before, remains in this position so long as actuator magnet 31 is energized. At this stage of the operation 31 remains energized so long as 70 is positive, since the gap between 32 through 38 to minus is bridged through leads 83—84—wiper 22—87—145—144 lead 86—wiper 21—minus. Therefore, during the existence of this connection, 31 is only energized, and wipers 21, 22, 23 advanced one step when follower 114 leaves 116. It should be noted that this connection bridging 32—38 exists so long as wipers 21 and 22 remain on interconnected contacts 1:11 to 10:11 and 1:12 to 10:12, respectively. It should also be noted that actuator magnet 34 of pause or sequence switch P is at this stage not energized, as will be apparent by tracing the connections from stepping switch 35, normally contacting with 39, which lead to selector contacts 22:11 and 23:15.

It is further apparent that alarm relay R is deenergized whenever the circuit from 70 through 77—143 of control relay C—146—82—153 of limiting relay L—156—71—62—66—R—73—144—86 wiper 21—minus is interrupted at 114—116 of the impulse sender I. Assuming again that one signal manifestation as, for example, one stroke of a bell, corresponds to each deenergization of R or R', each interruption at 114—116, or disconnection of point 70, produces such a stroke. Hence, wipers 21, 22 and 23 move now in unison one step at each disconnection of point 70 or each half turn of shaft 121, until wiper 23 reaches the first selector contact plugged in or otherwise selected at the digit setter D. In the present instance, contact 3:13 of selector unit 13 (transmitting or impulse counting switch T) is connected to contact 1:16 of selector unit 16 (pause or sequence switch P) through number bus 2 and digit bus h. Since the wipers advance, and alarm relay R is deenergized at each interruption at 114—116, of the above traced circuit from plus through 70—77—143—146—82—153—156—71—62—66—R—73—144—86—21 to minus, a signal stroke is given by alarm relay R at each advance of the wipers. Therefore, the wipers of T have now advanced twice, wiper 23 resting at contact 3:13, and two

strokes have been sounded, corresponding to the hundred digit 2 of the special signal number "213".

The contact between wiper 23 and contact 3:13, immediately following the interruption at 114—116, the second bell stroke, and the connection at 32—38 to minus, establishes a circuit from the plus pole at 53 of stopping relay S through 52—81—42—78—79—141—95—wiper 26—contact 1:16—bus h—2—3:13—23 to 85, and from there to negative at 38 through 83 and 32, as well as to negative at 21 through 84—3:12—22—87—145—144—86—3:11—21. This circuit energizes magnet 141 of control relay C which thereupon attracts its armature members, disconnecting contact 143 from contact 146. This interrupts the aforementioned circuit which includes alarm relay R, thereby preventing energization of that relay (and therefore signal strokes due to following deenergization), so long as contacts 143 and 146 are separated. Energized magnet 141 also attracts member 142, thereby closing contact 142—144 and subsequently opening contact 144—145. Contact 142—144 establishes a holding circuit for magnet 141, from positive at 53 through 52—81—42—78—79—141—142—144—86—21 to negative, which retains 141 energized independently of the position of wiper 23. It should be noted that this holding circuit of magnet 141 includes selector unit 11 and can only remain closed so long as wiper 21 remains on the contacts which are connected to wire 86, that is, contacts 1:11 to 10:11.

The opening of contacts 144—145 interrupts the aforementioned shunt of contacts 32—38, which, as pointed out above, connect magnet 31 to negative and maintain it energized at all times when follower switch 114 and impulse contact 116 are closed, so that actuator magnet 31 is now independent of the impulse sender and energized through 32 whenever the latter contacts 38, whereupon it attracts 32, is deenergized, and so on, thereby vibrating and quickly advancing wipers 11, 12 and 13. The wipers pass thus quickly over their respective contacts whereby magnet 141 remains energized through the interconnected contacts of selector unit 11.

When the last of these contacts, namely 10:11, is passed, magnet 141 is deenergized and its switches restored to normal. However, alarm relay R can not yet be operated by impulse switch 120, because its energization circuit leads through selector switches 11 or 12, both of which now interrupt this circuit since their wipers have passed the connected contacts. Stepping switch 32 continues quickly to advance its wipers until wiper 23 reaches contact 13:13 which is directly connected to negative. Actuator magnet 31 is now again directly energized through 70, and 32 remains stationary until 31 is deenergized after the next opening of impulse contacts 114—116. Thereupon 32 steps its wipers once, 23 leaves contact 13:13, the shunt of 38—32 is removed and the wipers advance again quickly. The connection of contact 13:13 to negative and the ensuing operation have the purpose of making all pauses between digits substantially alike, as will be evident by considering that, no matter from which of the selector contacts of selector 13 wiper 23 starts to vibrate, it is held up at 13:13 after one impulse period and started again from a position of the impulse switch which is the same no matter from which selector contact wiper 23 commenced to vibrate.

The wipers 21, 22, 23 pass now quickly on to the last but one contacts of their respective selector units. It will be noted in this connection that the passing of wiper 23 over the contacts joined with each other, and to contact 3:15 of selector unit 15, is of no consequence at this time, since wiper 25 of unit 15 rests then at the idle contact 1:15.

Upon arriving at contact 22:13, wiper 23 connects magnet 31 directly to negative, thereby stopping the quick advancement of the wipers of T, with these wipers at the aforementioned penultimate selector contacts. Wiper 21 at contact 22:11 establishes a circuit from negative through 21—22:11—39—154—158—actuator magnet 34—70 to plus at follower switch 114 so that actuator magnet 34 of pause switch P is energized and, upon the next disconnection at 114—116 advances the wipers 24, 25 and 26 of control switch P one step, so that wiper 26 rests now at contact 2:16 which is connected to digit bus *t*. Wipers 24 and 25 are at unconnected contacts 2:14 and 2:15, respectively. As will be understood without further explanation, the interruption at impulse contacts 114—116 also advances the wipers of transmitting switch T, which stand now at the last contacts of their respective selector units. Since contacts 23:12 and 23:11 are unconnected, but 23:13 is connected to negative, the next interruption at 114—116 advances these wipers one step further to their initial positions where their opposite, heretofore idle brush arms contact with 1:11, 1:12 and 1:13, respectively. It should be noted that, since contact 23:11 is idle, actuator magnet 34 of pause switch P remains deenergized after the one step advancement of its wipers, which therefore remain at their above-indicated positions at the second contacts of their respective selector units.

The elements of the circuit are now in the same position as at the beginning of the transmission of the first digit "2", with the only difference that the wipers of pause switch P have advanced one contact, that is, as pointed out before, wiper 26 rests at the selector contact 2:16 which is connected to the tens digit bus *t*. The following operation is exactly like that for the hundreds digit, and at the end of the transmission of the tens digit the wipers of P are located at the third selector contact, that is, wiper 25 rests at 3:15 which is connected to the five interconnected contacts 17:13 to 21:13 of transmitting switch T. The transmission of the third, or unit digit now takes place in the same manner, until wiper 23 reaches contact 17:13. At this stage, a circuit is completed from actuator switch 32 through 33—35—23—17:13—38—3:15—25 to negative, that is, magnet 31 is now directly on negative and can not quickly advance the wipers of transmitting switch T to the penultimate contacts, but can only advance them step by step at each interruption at impulse contacts 114—116, until they arrive at these penultimate contacts, namely, 22:11, 22:12 and 22:13, respectively. Contact 3:15 and wiper 25 are then again disconnected, but magnet 31 remains directly connected to negative, which connection is accomplished through 22:13—23—35—33. As described above, the wipers of P advance one step, wiper 25 arriving at 4:15 and wiper 26 at 4:16, which is connected to box number digit bus *h'*, and the wipers of T are restored to their initial position.

It will now be evident that a uniform "digit pause" corresponding to one impulse period or interruption at 114—116, or one step of wiper 23, is provided between two subsequent strokes of one

digit; that a "number pause", similarly corresponding to the four steps of wiper 23 (at 1:13, 13:13, 22:13 and 23:13) is provided between consecutive digits of one number, and that a "group pause" corresponding to one step of wiper 23 at 13:13, seven steps from 17:13 to 23:13, and one step at 1:13 (a total of nine steps) is provided between numbers.

With the relays in the position above indicated (wipers of transmitting switch T in initial position and wipers of P on fourth contact), the device according to the invention begins to transmit the box number set up with the aid of busses *h'*, *t'*, *u'*, in a manner identical to that above described for sending the special signal. There is again a pause equivalent to one stroke between the strokes, a four-stroke pause between digits, and a nine-stroke pause between numbers. If it is desired, as, for example, in the present set up, to send the box number twice, round plug 90 is connected to round jack II.

In the assumed instance, after having transmitted the last stroke of the last digit of the second repetition of the box number group, wiper 25 has reached contact 10:15 (connected with round jack II) wiper 23 stands on contact 22:13 and wiper 21 on 22:11, waiting for an interruption at contacts 114—116 of the impulse sender to be shifted to the last contact. At this stage, however, a circuit is established from minus at wiper 25 through 10:15—11—90—93—magnet 151—79—78—42—81—52—53 to plus, which circuit energizes magnet 151 of the limiting relay L, which thereupon attracts its armature members 152, 153 and 154. Contacts 152—155 establish a holding circuit for 151 from negative at 152 through 151—155—151—79—78—42—81—52—53 to plus, which remains closed as long as maintenance magnet 41 remains energized. The separation of contacts 153—156 interrupts the energization circuit of alarm relay R, which is from now on incapable of manifesting signals. The attraction of member 154, which has up to now shunted contacts 35 and 39 of pause switch P (preventing vibration of actuator switch 35) directly connects minus at 157 through 154—39—39—35—34 to 70, causing actuator switch 35 to vibrate. Wipers 24, 25, 26 are quickly advanced during the periods when 114—116 contact, until they reach the last contacts of their selector units. Wiper 25 arriving at 23:15 puts 34 again directly on negative and stops it vibrating, so that all six wipers stand now on the last contacts of their selector units. Wiper 24 on contact 23:14 thereupon establishes a circuit from plus at 24 through 23:14—91—51 of the stopping relay S to negative, which circuit energizes the slowly releasing magnet 51 of relay S. Magnet 51 attracts its armature 54, thereby shifting the positive supply connection of maintenance magnet 41 (through 53—52—81—42—41) from 53 to 24 (through 52—54—91—24—positive). Magnet 41 remains for the time energized and maintains the energizing circuit of the actuators 31 and 34 through point 70, switch 44 and impulse sender contacts 114—116. At the next interruption of this circuit at 114—116, all wipers are moved home into their initial positions. Magnet 41 is deenergized by the break at 23:14 and drops its armature switches 42, 43, 44. This stops motor 122 at 43, opens the holding circuit of magnet 41 at 42 and disconnects impulse wire 77 at 44. Magnet 151 of limiting relay L is thereby deenergized. Shortly afterwards, armature 54 of magnet 51 of stopping relay S has dropped so that the whole

device is restored to normal and ready for further operation, either for sending the same signal by again pressing starting key K, or for sending another signal by rearranging the connections at digit setting device D and thereafter pressing the key.

Numbers with two digits, or only one digit, can be transmitted by plugging the digit bus or busses corresponding to the omitted digit or digits into number bus 0. In that case, stepping magnet 34 is energized when wiper 21 engages contact 22:11 whereupon wiper 26 of unit 16 advances one step onto contact 2:16. Wiper 23 moves over the selector contacts of unit 13 without initiating a signal stroke, as will now be apparent without detailed explanation of the connections and circuits involved.

If transmission of the special signal only is desired, plug 90 is connected to receptacle X so that signal transmission is terminated with the last stroke of the unit digit of the special number.

It will now be evident that the signal presetting device of the invention, combined with the automatic transmission of the prearranged signal, provides for visualization, and therefore almost certain correctness of the number to be transmitted, which excludes any errors during repeated transmission thereof, as invariably occur when the signal impulses are manually repeated, for example, with the aid of a telegraph key.

The embodiment shown in Fig. 2 is essentially identical with that of Fig. 1 with the exception that the digit setting device D is, in this modification, replaced by a number distributor or pre-selector N and digit automat A which, together with holding relay H, actuating relay G, and alarm circuit relay F or telephone dial E, permits the automatic setting up or storing of code signals, and the subsequent automatic transmission of these signals.

The number distributor N is substantially a telephone selector switch of a well known type and comprises a selector unit 210 with a row of ten selector contacts which will herein be referred to as 1:210 to 10:210, respectively, a single arm wiper 220, an actuator magnet 214, a restore magnet 224 and a retaining switch 230. With this type of selector switch, the wiper contacts initially with the first contact 1:210, is moved one step by each deenergization of actuator magnet 214, and restored to initial position at 1:210 by restore magnet 224 when the latter is energized. The retaining switch 230 is closed when the actuator magnet 214 is first energized, and remains closed until the wiper is returned to its initial position. Switches of this kind are quite similar to the more widely used type where a control switch is not closed until the magnet is deenergized; the only difference is that switch 230 is closed by the initial energization of magnet 214 instead of its first deenergization.

The digit automat A consists essentially of three selector switches like that of distributor N and has three selector units 211, 212, 213 with wipers 221, 222, 223, respectively, actuator magnets 215, 216, 217, respectively, and restore magnets 225, 226, 227, respectively. These three selector switches operate independently of each other similar to distributor N, with the exception that only the first one is provided with a retaining switch 231 which is closed when actuating magnet 215 is energized and opens when the wiper of this magnet returns to initial position. As shown in Fig. 2, the contacts of units 211, 212, 213 are joined to the number busses of trans-

mitting switch T in such a manner that contacts 1:211, 1:212, 1:213 are connected to bus 0, contacts 2:211, 2:212, 2:213 to bus 1, etc., corresponding contacts of each unit being associated with the same number bus. Wipers 221, 222, 223 are connected to digit busses h', t', u', respectively. The contacts of selector unit 16 of pause switch P are connected to the digit busses in groups of three, that is, contacts 1:16, 4:16, 7:16 are connected to bus h'; 2:16, 5:16, 8:16 are connected to t'; and 3:16, 6:16, 9:16 are connected to u'. The terminals on one side of each restore magnet 224, 225, 226, 227 are connected to negative as indicated, the other terminals are joined and connected, through lead 96, to wire 91 which leads as in the embodiment of Fig. 1, from contact 23:14 to stopping relay S. The terminals on one side of each actuator magnet 215, 216, 217 of automat A are connected to contacts of the number distributor N, as shown, magnet 215 being associated with contact 2:210, 216 with 3:210 and 217 with 4:210. Contact 1:210 is idle. The other terminals of the actuator magnets are connected to negative.

It is herein assumed that it is only required to store one number at one time, and accordingly no provisions are made for a "special signal", and the embodiment according to Fig. 2 has therefore only one set of digit busses h', t', u', to which the contacts of unit 16 are connected as above described.

The receptacle X of unit 15 is directly connected to negative. By connecting jack 90 with this receptacle, relay L is directly connected to negative and energized, and the entire circuit conditioned inoperative for signal transmission, as will be readily understood from the following description.

The holding relay H comprises a magnet 241 which controls switch members 242 and 243 co-operating with fixed contacts 244, 245 and 246. Magnet 241 is normally energized, retaining members 242 and 243 in raised position and in contact with fixed contacts 244, 246, respectively. Magnet 241 is of the type which attracts an armature quickly, but releases it slowly, having, for example, a copper sleeve mounted on the magnet core. When members 242 and 243 are released after a predetermined period, fixed contacts 244 and 246 are disconnected, whereas contact 245 connects with member 242.

Actuating relay G has a magnet 251, three armature members 252, 253, 254 and three fixed contacts 255, 256, 257. Magnet 251 is likewise of the retarded type, but releases its armature still slower than magnet 241 of holding relay H, as indicated by its longer sleeve. The delay periods of magnets 241 and 251 must be properly timed with respect to the operation of the signal storing device as a whole, in a manner which will be evident from the following description. Magnet 251 is normally deenergized, and in this condition members 252—255 and 253—256, respectively, contact, whereas members 254 and 257 are disconnected. Upon energization of magnet 251, contacts 252—255 and 253—256, respectively, are disconnected and 254—257 are connected.

The fire alarm circuit relay F (hereinafter referred to as "fire relay") has a magnet 261 and a switch member 262 associated with fixed contacts 263 and 264. Magnet 261 is normally energized, since it is assumed to be part of a conventional fire alarm circuit which carries current under normal conditions and contains alarm

boxes and manifesting relays (corresponding to relay F) in series connection. The code signal impulses are transmitted as circuit interruptions, each interruption causing a deenergization of magnet 261 in a manner to be described in detail hereinafter. Contacts 262 and 263 are disconnected, and contact is established between members 262 and 264, at every deenergization of magnet 261. It is, however, understood that relay F is not necessarily part of a conventional fire alarm circuit, and that it can be replaced by any instrumentality adapted to manifest code signals in a manner similar in effect to the dropping of member 262 from contact 263 to contact 264.

The switch E is a conventional telephone dial with two normally closed impulse contacts 271 and 272 and normally separated off normal contacts 273, 274 and 275. When dialing commences, contacts 273, 274 and 275 close. They remain closed during dialing, but are open whenever the dial is at rest. Impulse contacts 271, 272 are opened during the effective return movement of the dial a number of times corresponding to the number of impulses to be transmitted for each dial turn. In other words, when, for example, the operator dials "213" and begins to turn the dial disk clockwise, switches 273—274—275 close. When the disk returns, contacts 271—272 open and again close two times, and then 273—274—275 open again. When the tens digit "one" is dialed, 273—274—275 close, 271—272 send one impulse by opening once, and 273—274—275 open, and similarly for the unit digit.

As shown in Fig. 2, one terminal of magnet 241 is connected to negative, and the other to contacts 263 and 275. Contacts 242, 264, 274, 257, contacts 243, 253 and contacts 272, 273, 254, respectively, are joined in three groups and contact 252 is connected to the positive terminal of the battery. Actuator magnet 214 of distributor N is connected between contacts 245 and 246, through wire 281, and the negative terminal of the battery. Wiper 220 is joined to contact 232 of the retaining switch and through wires 282 and 288 to contacts 244 and 256. Through lead 283, contact 230 is connected to one terminal of magnet 251 of actuating relay G whose other terminal leads to the negative side of the battery.

Instead of being manually controlled like starting key K of the modification according to Fig. 1, starter key K' of the present embodiment has a magnet 200 whose terminals are connected to contacts 233 and 255, through wires 99 and 98, respectively, and which, upon energization, connects contacts 103—201 and 104—202, respectively. Maintenance relay M' of this embodiment has an additional contact 49 connecting with armature member 42 when magnet 41 is deenergized. From contact 49 leads a wire 97 to switch 290 with contacts 292 and 293. Contact 292 is connected to dial contact 271 through lead 286, and contact 293 is joined to switch member 262 of fire relay F. By shifting switch 290, control of the digit automat can be transferred from fire relay F to telephone dial E and vice versa. The remainder of the circuit is organized exactly as described in connection with Figs. 1 and 3, and need not be repeated.

This embodiment, incorporating the automatic signal storing device as shown in Figs. 2 and 5, operates as follows: Assuming that it is desired to store and to transmit code signals arriving from a conventional fire alarm circuit, switch

290 is positioned as shown, connecting lead 97 with armature member 262 of normally energized fire relay F. A circuit is thus established from positive at 53 through 49—97—290—263—241 to negative, which circuit normally energizes magnet 241 of holding relay H. Contact is therefore maintained at 242—244 and at 243—246, during normal conditioning of F, and a certain period after magnet 261 is deenergized, which period corresponds to the time lag of magnet 241. As pointed out before, relay F may be part of any conventional signaling system transmitting signals in the form of current modifications arranged according to a code. In the present instance it is assumed that code signals manifested at F are of the conventional fire alarm type, as illustrated in Fig. 4. This timing diagram indicates the periods (identified by letters a, b, c, etc.) when magnet 261 is energized and deenergized, respectively, the code signal received at F representing the number of a fire alarm box, for example, "213".

At the moment a when magnet 261 is first deenergized, armature switch 262 of relay F drops, establishing connection at 264 but breaking contact at 263 and deenergizing magnet 241, which, however, as already mentioned, releases its armature members 242 and 243 only a certain time after its deenergization. Hence, a circuit is closed from positive at 53 through 262—264—242—244—282—288—256—253—243—246—281—214 to negative. This circuit energizes actuator magnet 214 of number distributor or preselector N. At the same time, retaining switch 230—232 closes due to the construction of device N as described hereinabove and establishes a circuit from plus at 53 through 282—232—230—283—251 to negative, energizing magnet 251 of actuating relay G, which immediately attracts its armature members 252, 253 and 254. Member 253 opens the above-traced energization circuit of stepping magnet 214, whereupon wiper 220 advances one step from unconnected contact 1:210 to contact 2:210. Member 242 of H having not yet been released, a circuit is established from positive through 290—262—264—242—244—282—wiper 220—2:210—215 to negative, energizing actuator magnet 215 of automat A and closing retaining switch 231—233.

The components of this circuit remain in that position until (at point b of Fig. 4), magnet 261 of relay F is again energized, attracting its armature member 262. It should be noted that the connection at 262—263 reenergizes magnet 241 of H, whereas magnet 251 of G is deenergized, although its armature has not yet dropped away, so that contacts 252 and 253 are still open. It should also be noted that the closing of retaining switch 231 of automat A has as yet no effect since its circuit is open at 255 of G. The interruption at 262—264 opens the energization circuit of actuator magnet 215 which thereupon advances wiper 221 one step from selector contact 1:211 to contact 2:211.

The circuit remains now unchanged until magnet 261 of F is again deenergized (point c of Fig. 4), dropping 262. Magnet 241 has not yet released its armatures, therefore magnet 251 (which also has not released its armatures), becomes reenergized. At 262—264, a circuit from positive through 242—244—282—220—2:210—215—negative is again closed, energizing stepping magnet 215 a second time. There has now been reached the number pause between points c and d of Fig. 4, during which magnet 261 remains 75

deenergized. The retarding device of magnet 241 is so designed that its armatures drop away after a period from the last deenergization (indicated at *c'* of Fig. 4) which is shorter than the time interval *c—d*, and therefore the energization circuit of stepper magnet 215 is now interrupted at 242—244 and stepper 221 is again advanced one step, making connection with number bus 2 through contact 3:211. Contacts 262—264 and 242—245 reestablish the energization circuit for actuator magnet 214 of distributor N, since relay G is so timed that its armatures will not drop away during the period *c—d* and a certain period thereafter.

At the beginning of the manifestation of the next digit "one" (point *d*), magnet 261 is again energized, and therefore also magnet 241, as will now be evident. Magnet 261 attracting member 262 opens the energization circuit of actuator magnet 214 at 264 (the circuit is also broken at 245) and wiper 220 is moved another step forward to contact 3:210, establishing connection with actuator magnet 216 of selector unit 212 of the digit automat.

As will now be apparent, the next deenergization (at point *e*) of magnet 261 causes stepper magnet 216 to be energized. The next period being again a number pause, relay 241 drops its armatures at point *e'*, deenergizing stepper magnet 216 and advancing wiper 222 one step, from 1:212 to contact 2:212, connected with number bus 1. The next and last digit "three" is then set up by moving wiper 223 three steps to contact 4:213 connecting with number bus 3, in a manner which will now be understood without further explanation.

After the last digit stroke is set up there ensues a pause, between the numbers of a so-called "round" of signals manifested at 261, which pause is longer than those between the strokes and the digits of any number, and during which the signaling circuit and magnet 261 are not carrying current. Magnet 261 is therefore deenergized during this pause (beginning at point *l* of Fig. 4) and retaining magnet 251 is deenergized, which finally releases its armatures at point *l'* of Fig. 4. It thereby closes contacts 252 and 255, establishing a circuit from plus at 252 through 255—98—200—99—233—231 to negative. Magnet 200 of the starter K' is therefore energized, and lifts its armature contacts 201, 202 into contact with fixed contacts 103 and 104.

This operation of starter K' has exactly the same effect as the pressing of the starting key described in connection with Fig. 1, namely, the transmission of the stored code signal for manifestation at relay R. It will of course be understood that the circuits from the number busses through the wipers of the digit automat to the digit busses *h''*, *t''*, *u''* (as, for example, from number bus 2 through 3:211—221—*h''*, to 1:16 correspond exactly to the manually plugged connections at digit setting device D of Fig. 1, with the hereinbefore mentioned difference that there is no provision made for setting up a special number since the fire alarm circuit transmits only a box number.

At the end of the transmission of a predetermined number of code signals (in the present case two number groups, since plug 90 is connected to jack II), wiper 24 of pause switch P arrives at contact 23:14 which is in this modification connected to wire 96 leading to restore magnets 224, 225, 226 and 227. Hence, a circuit is established from plus at wiper 24 through

23:14—96—restore magnets to negative, the restore magnets are energized, the wipers of N and A restored to initial position and switches 230—232 and 231—233 opened. The opening of 231—233 deenergizes magnet 200, so that the entire circuit is now restored to its initial condition.

If it is desired to set up a code number and to transmit it a certain number of times merely by dialing it once on a conventional telephone transmitter, switch 290 is turned to make contact at 292. It will be evident that the operation of the dial initiates current impulses which correspond exactly to those caused by relay F, as above described.

Therefore, when the operator receives an alarm call, he selects the appropriate code number and dials it once at E, which may be a separate dial at the operator's switchboard or desk. As explained above, contacts 273, 274 and 275 are closed upon commencement of dialing and remain closed during the entire dialing period. During closure of these contacts, relay 241 is energized from minus pole through 275—274—273—272—271—292—290—97—49—42—81—52—53 to plus pole. Therefore, although relay 241 is deenergized when the dial is at rest, it becomes energized as soon as dial operation begins, and the further operation proceeds exactly as in the case when the device is connected to relay F, regardless of the fact that relay 241 is deenergized while dial mechanism E is at rest. Without any further operation the number is repeated into the fire alarm circuit and manifested with the aid of relay R a number of times which can be determined by properly connecting plug 90 of pause switch P, whereupon the circuit is automatically restored to initial condition and ready for transmission of another signal.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. An electric code signal transmitting device comprising output contacts for connection with a signal receiving circuit, means for supplying current impulses at regular intervals to said contacts, maintenance means normally disconnecting said contacts from said impulse supply means, normally deenergized driving means for said impulse supply means, means for operatively energizing said driving means, means for closing said maintenance means, holding means maintaining the energization of said driving means and the connection of said contacts, contact means in series with said maintenance means for disassociating said impulse supply means from said contacts after reception of a predetermined number of impulses, means for reclosing said contact means after omission of a predetermined number of receptions, and means for inactivating said holding means after reception of a predetermined number of impulse groups.

2. A code signal transmitter comprising means for supplying code signaling impulses at regular intervals throughout the transmission of an intended code signal and for supplying a starting impulse during the interval between each of the signaling impulses, an impulse counting switch having a stepping magnet operable by said signaling impulses, a sequence switch having a stepping magnet likewise operable by signaling impulses, a maintenance relay in a normally open

starting circuit said relay being energized in response to said starting impulses during closure of said starting circuit and having a transmitter control circuit for initiating and maintaining operation of said switches throughout energization of said maintenance relay and a locking circuit holding said relay energized, a control relay, means for supplying said impulses to said counting switch, means supplying a signaling impulse to said sequence switch for operation thereof at a predetermined position of said counting switch, circuits including said switches for controlling said control relay jointly by said switches for interrupting the supply of said impulses in response to predetermined positionings of said switches, to formulate said intended code signal, and a stopping relay controlled by said sequence switch for interrupting said locking circuit following complete transmission of the signal.

3. A code signal transmitter comprising means for supplying code signaling impulses at regular intervals throughout the transmission of an intended code signal and for supplying a starting impulse during the intervals between each of the signaling impulses, an impulse counting switch having a stepping magnet operable by said signaling impulses, a sequence switch having a stepping magnet operable by said signaling impulses, a maintenance relay in a normally open starting circuit said relay being energized in response to said starting impulses during closure of said starting circuit and having a transmitter control circuit for initiating and maintaining operation of the said switches throughout energization of said maintenance relay, a control relay, means for supplying said impulses to said counting switch, means supplying a signaling impulse to said sequence switch for operation thereof at a predetermined position of said counting switch, and circuits including said switches for controlling said control relay jointly by said switches for interrupting the supply of said impulses in response to predetermined positionings of said switches, to formulate said intended code signal.

4. In a code signal transmitter, means for supplying to a signal transmitting circuit code signaling impulses at regular intervals throughout the transmission of an intended code signal, two selector switches each having a plurality of contacts and a stepping magnet operable by said impulses for establishing connections step by step with consecutive ones of said contacts, a plurality of code setting circuits each comprising means for establishing a connection between any one of certain of the contacts of one of said switches and any one of certain contacts of the other of said switches, a relay energized through respective ones of said circuits when connection is established therewith through said switches concurrently, said relay having contacts operable in response to energization thereof for interrupting the supply of code signaling impulses to said signal transmitting circuit, thereby formulating groups of signal impulses constituting a code signal unit, means for supplying said impulses to one of said switches, and means for supplying, after said first switch has advanced a predetermined number of steps, one impulse to the second one of said switches, for changing the effective contact of said second switch, after formulation of a code signal unit through operation of said first switch.

5. In a code signal transmitter, means for supplying to a signal transmitting circuit code signaling impulses at regular intervals throughout the transmission of an intended code signal, two selector switches each having a plurality of contacts and a stepping magnet operable by said impulses for establishing connections step by step with consecutive ones of said contacts, means for preparing connections between predetermined contacts of the respective switches, a relay energized by concurrent connections, through said switches, of a contact of each of said switches for interrupting the supply of code signaling impulses to said signal transmitting circuit to formulate an intended code signal therein, means for supplying said impulses to one of said switches, and means for supplying one impulse to the second one of said switches after said first switch has reached a position corresponding to a certain number of steps, to change the contact connection of said second switch after formulation of a signal by a preceding contact combination, for preparing the formulation of a subsequent signal.

6. An electric code signal transmitter circuit comprising means for supplying code signaling impulses at regular intervals throughout the transmission of an intended code signal, an impulse counting switch having a stepping magnet operable by said impulses, a sequence switch having a stepping magnet likewise operable by said impulses, means for preparing circuits made effective by certain positions of said switches, a control relay, and means, controlled by one of said switches, for operating the other switch to change its contact connection after formulation of a signal by a preceding contact combination, for preparing the formulation of a subsequent signal, said relay being jointly controlled by said switches for interrupting the supply of code signaling impulses at predetermined positions of said switches to formulate an intended code signal, means for supplying said impulses to one of said switches, and means for supplying one impulse to the second one of said switches after said first switch has reached a position corresponding to a certain number of steps, to change the contact connection of said second switch after formulation of a signal by a preceding contact combination, for preparing the formulation of a subsequent signal.

7. A code signal transmitting device comprising a signal receiving circuit; means for supplying to said circuit current impulses at regular intervals throughout the transmission of an entire code signal communication, in series in said circuit; a stepping switch including an actuating magnet and an automatically interrupting quick acting energizing means for said magnet in series to said impulse supply means and in parallel to said circuit; means for initially shunting said energizing means and periodically energizing said magnet through said impulses; means in series in said circuit operated by said stepping switch for disassociating said impulse supply means from said circuit after supplying thereto a predetermined number of consecutive impulses; means for removing said shunt upon operation of said disassociating means, thereby quickly advancing said stepping switch through actuation of said magnet with said energizing means; and means for again establishing said shunt after a time period measured by said impulse supply means.

8. A code signal transmitting device compris-

ing a signal receiving circuit; means for supplying to said circuit current impulses at regular intervals throughout the transmission of an entire code signal communication, in series in said circuit; a stepping switch including an actuating magnet and an automatically interrupting quick acting energizing means for said magnet in series to said impulse supply means and in parallel to said circuit; means for initially shunting said energizing means and periodically energizing said magnet through said impulses; means in series in said circuit operated by said stepping switch for disassociating said impulse supply means from said circuit after supplying thereto a predetermined number of consecutive impulses; means for removing said shunt upon operation of said disassociating means, thereby quickly advancing said stepping switch through actuation of said magnet with said energizing means; and means, actuated by said stepping switch upon assuming its quick advance, for reclosing said disassociating means and simultaneously disassociating said impulse supply means from said circuit.

9. Code signal transmitting means comprising a current source; a signal receiving circuit; means supplying from said current source impulses at regular intervals to said circuit; a normally closed cutout intermediate said supply means and said circuit; a digit setting device having two series of conductors and means for selecting connections between conductors of different series; an impulse counting stepper magnet and a quickly interrupting and reclosing vibrator switch connected to said source in series with said impulse supply means and in parallel to said circuit and said cutout; means normally shunting said vibrator switch controlled by said magnet; a first stepping switch actuated by said impulse counting magnet, having a wiper connected to said magnet in parallel with said vibrator, a series of contacts with a number of consecutive contacts connected to one conductor series of said setting device, and a synchronizing contact following said initial contacts connected to said source; a sequence stepper magnet connected in series to said impulse supply means; a normally open energizing contact closed by said impulse counting magnet towards the end of its cycle of operation, in series to said sequence magnet; a second stepping switch actuated by said sequence magnet having a wiper and a series of contacts connected to the second series of conductors of said setting device; and a control magnet in series with said second stepping switch and upon energization opening said cutout and said shunting means; said stepper contacts and wipers being so coordinated that each current impulse reaches said circuit and energizes said impulse counting magnet until said first wiper reaches a contact connected by said setting device with said second stepping switch, said control magnet thereupon opening said cutout and opening said shunting means thereby causing said impulse counting magnet to advance its wiper quickly until said synchronizing contact is reached, where the vibrator is again shunted and the impulse supply means effect a further step of the impulse counting magnet which again removes the vibrator shunt and advances said first wiper quickly until said energizing contact connects said sequence magnet, the impulse supply means then energizing said sequence magnet, advancing said second stepping switch one contact to connect with another conductor of said second series and returning said first stepping switch into initial position, said operation being repeated until said third wiper reaches one of its connected contacts, causing said vibrator switch to be shunted and to advance slowly forming a comparatively long pause prior to repetition of the signal prepared with said contact group.

11. A device of the character described comprising means for manifesting code groups of long and short signal impulses, digit selectors arranged for establishing in consecutive positions different signal actuating circuit connections, a preselector adapted to condition for actuation consecutive ones of said selectors, an actuating

second series and returning said first stepping switch into initial position.

10. Code signal transmitting means comprising a current source; a signal receiving circuit; means supplying from said source current impulses at regular intervals to said circuit; a normally closed cutout intermediate said supply means and said circuit; a digit setting device having two series of conductors and means for selecting connections between conductors of different series; an impulse counting stepper magnet and a quickly interrupting and reclosing vibrator switch connected to said source in series with said impulse supply means and in parallel to said circuit and said cutout; means normally shunting said vibrator switch controlled by said magnet; a first stepping switch actuated by said impulse counting magnet, having a wiper connected to said magnet in parallel with said vibrator switch, a series of contacts with a number of consecutive contacts connected to one conductor series of said setting device, a synchronizing contact following said initial contacts connected to said source, and group-forming contacts following said synchronizing contact; a sequence stepper magnet connected in series to said impulse supply means; a normally open energizing contact closed by said impulse counting magnet towards the end of its cycle of operation in series to said sequence magnet; a second stepping switch actuated by said sequence magnet having a wiper and a series of contact groups, corresponding contacts of each group being connected in parallel to the second series of conductors of said setting device; a third stepping switch likewise actuated by said sequence magnet having contacts at intervals corresponding to the number of contacts in said groups connected to each other and to said group-forming contacts and a wiper connected to said source; and a control magnet in series with said second stepping switch and upon energization opening said cutout and said shunting means; said stepper contacts and wipers being so coordinated that each current impulse reaches said circuit and energizes said impulse counting magnet until said first wiper reaches a contact connected by said setting device with said second stepping switch, said control magnet thereupon opening said cutout and opening said shunting means thereby causing said impulse counting magnet to advance its wiper quickly until said synchronizing contact is reached, where the vibrator is again shunted and the impulse supply means effect a further step of the impulse counting magnet which again removes the vibrator shunt and advances said first wiper quickly until said energizing contact connects said sequence magnet, the impulse supply means then energizing said sequence magnet, advancing said second stepping switch one contact to connect with another conductor of said second series and returning said first stepping switch into initial position, said operation being repeated until said third wiper reaches one of its connected contacts, causing said vibrator switch to be shunted and to advance slowly forming a comparatively long pause prior to repetition of the signal prepared with said contact group.

11. A device of the character described comprising means for manifesting code groups of long and short signal impulses, digit selectors arranged for establishing in consecutive positions different signal actuating circuit connections, a preselector adapted to condition for actuation consecutive ones of said selectors, an actuating

relay controlled by said manifesting means causing said preselector to condition one of said selectors for actuation during the first short impulse, consecutively to condition different selectors during short impulses following long impulses, and to arrest the unconditioned selectors during each long impulse, and means for changing the circuit establishing positions of said conditioned selectors during each of said short impulses and a predetermined time after the beginning of each long impulse.

12. A code signal transmitting device comprising means for communicating code groups of long and short signal impulses; normally ineffective means for supplying to a signal transmitting circuit intermediate signal transmission impulses at regular intervals; means for starting said impulse supply means; two selector switches each having a plurality of contacts and a stepping magnet operable by said transmission impulses for establishing connections step by step with consecutive ones of said contacts; a plurality of code setting circuits including digit selectors establishing in consecutive positions different connections between any one of certain of the contacts of one of said selector switches and any

one of certain contacts of the other of said selector switches; a preselector adapted to condition for actuation consecutive ones of said digit selectors; an actuating relay controlled by said code group impulses, said relay causing said preselector to condition one of said digit selectors for actuation during the first short impulse, and thereafter consecutively to condition different digit selectors; means for changing the circuit establishing positions of respective ones of said conditioned digit selectors during each of said short impulses and at a predetermined time after the beginning of each long impulse; means for actuating said starting means upon discontinuation of said code group communication for a predetermined time; and a relay energized through a respective one of said code setting circuits when connection is established therewith by each of said switches concurrently, said relay having contacts operable in response to energization thereof for interrupting the supply of intermediate signal transmission impulses to said signal transmitting circuit thereby formulating groups of signal impulses constituting a code signal conforming with said code group signals.

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