

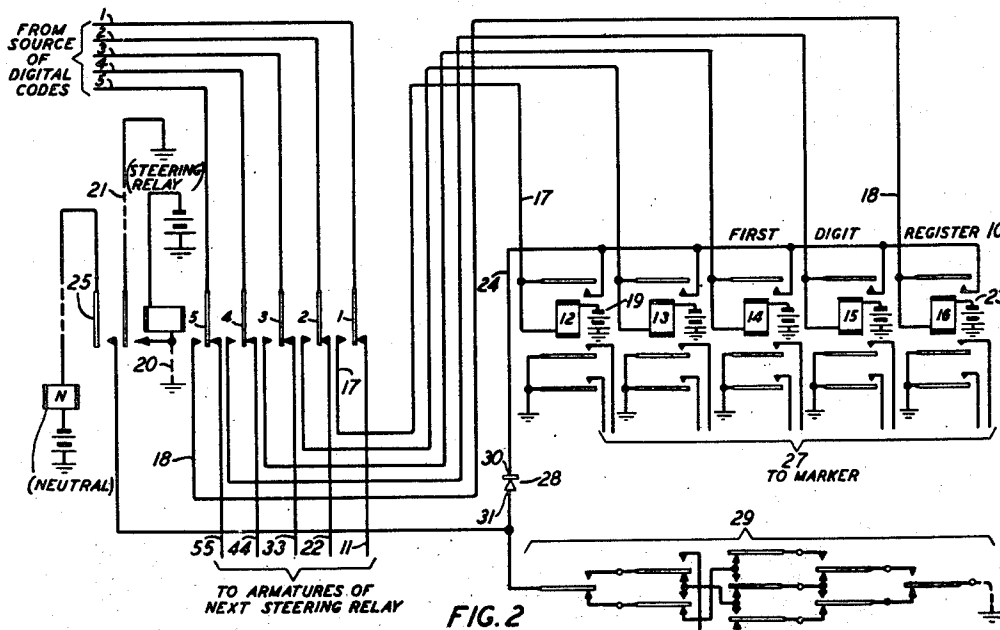
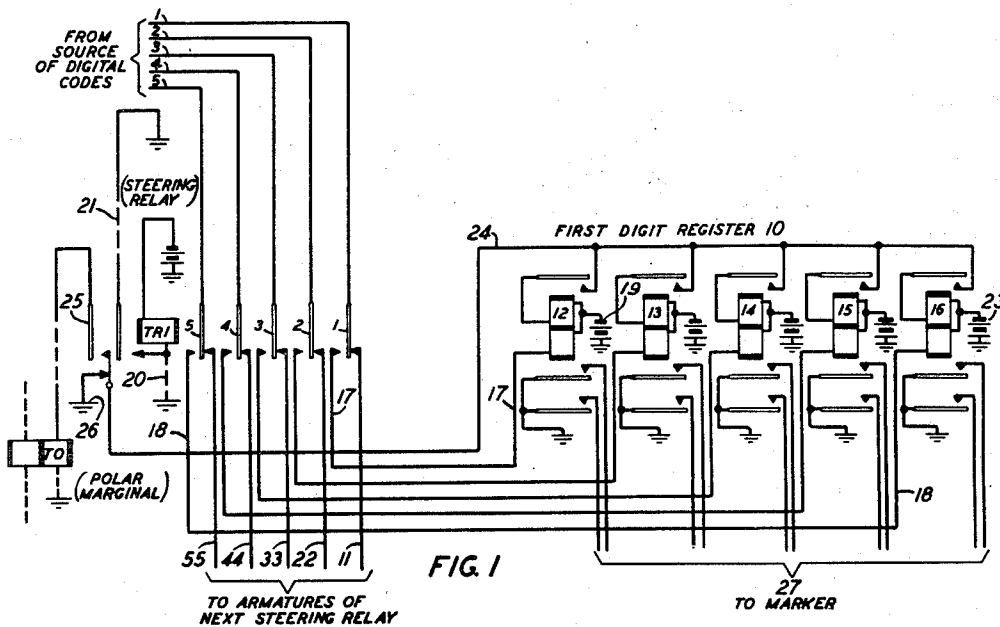
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REGISTRATION SYSTEM

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REGISTRATION SYSTEM

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This invention relates in general to automatic telephone systems and in particular to circuits within such systems for registering information.

In general use for some time in automatic telephony has been a system of signaling which is known to many in such art as the "two-out-of-five code" signaling. By means of such a signaling system a called number digit, for example, can be represented by any combination of two selected or abnormal conditions out of five unselected or normal conditions. For instance, in-register circuits commonly employed to register the digits of a called or calling number, as well as other items of information useful in the operation of automatic telephone systems, five register relays may be employed in a normally non-operated status such that in order to register any desired digit of a called number a prescribed combination of two operated relays out of the five will be intelligible into a digit by associated apparatus. The present invention is directed to improvement of such register circuits. However, the invention is not limited in its scope to called number digit registration since, as will be apparent to those skilled in the pertinent art, the invention is applicable to any registration system wherein such coded information is to be recorded for future use. Furthermore it will be apparent from the following description that the invention is not necessarily limited in its application to "two-out-of-five code" signaling.

As disclosed by example herein the invention is applied to a telephone system as disclosed in Patent 2,332,912 to G. Hecht, A. A. Lundstrom and E. R. Taylor of October 26, 1943, and other patents referred to therein. The Hecht et al. patent discloses a signaling system employing a multifrequency receiver which receives information on a two-out-of-five frequency basis. That is, a digit comprising information is transmitted to said receiver by means of a prescribed combination of two different frequencies in the audible range. The receiver amplifies this composite signal, separates the two frequencies into two separate channels, checks the existence of two frequencies, permits such frequencies to operate two separate digital relays and enables the initiating of digit register functioning to record the information on said two relays as two-out-of-five operated register relays. The receiver, if it checks improper reception of two frequencies, will effect a recorder on transmissions of the signal previously transmitted to said receiver. The present invention is, of course, not limited in its

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useful application to such systems as referred to specifically above.

The registration system disclosed by Hecht et al. is not fully disclosed herein but sufficient of it is set forth below and in the drawings to afford an understanding of the advantages of the present invention over such previous registering means.

In the following detailed description of one embodiment of the present invention reference will be made from time to time to the drawing forming a part of this disclosure. The various figures of the drawing may be described generally as follows:

Fig. 1 shows an excerpt from the Hecht et al. patent drawing and illustrates, in conjunction with certain descriptive matter hereinafter set forth, the essential parts of a registration system representative of the prior art; and

Fig. 2 shows a circuit embodying elements of the present invention arranged in one of its possible forms to more or less parallel the illustration of Fig. 1.

In previous register circuits, such as disclosed by the Hecht et al. patent, the register relays have been required to be dual-wound. This has been necessary so that the ground or battery signals which operate two of said relays will be independent of the holding windings of said relays. With such register circuits as shown in Fig. 1 a polar relay has been employed to be operated in series with holding windings of operated relays in order to provide some check on the number of relays permitted to be locked in operated position. The use of polar relays is expensive, and as used by Hecht et al., requires a separate two-out-of-five check to get a comprehensive over-all insurance of correct registration. Some previous register systems or circuits have employed a two-out-of-five checking path through contacts of all register relays, as employed in Fig. 2. This familiar contact arrangement provides a ground or battery path when, and only when, two only of the register relays operate. Many other arrangements of such contact lattices are known to enable a check of any subgroup of a plurality of relays. Even the use of such a contact arrangement does not obviate the necessity of double winding register relays because of locking reasons since the checking relay might be falsely operated by signal lead potential.

The previous requirement for double winding register relays where the aforementioned functions need to be performed led to the desire for a satisfactory single winding relay circuit which

could meet all of these functional needs. The present invention provides such a register circuit which is somewhat faster than previous types, especially those using polar relays, requires no polar relays, provides a more comprehensive check and as a result of one or more of these advantages is less expensive and more positive in its functioning. Briefly the present invention enables the use of single winding register relays by so locating a unidirectional current circuit element in the register circuit as to permit the signal leads to operate register relays and to permit said operated relays to lock up but to prevent the signal leads from affecting the operation of a checking relay.

Fig. 1 shows the essential elements of one of the register circuits of the Hecht et al. disclosure. The five code leads 1 to 5 bracketed as shown coming "From source of digital codes" are designed to carry two-out-of-five grounds from any desirable source of such coded signals. In the Hecht et al. disclosure this source is the aforementioned receiver circuit wherein, as a result of having resolved a multifrequency signal transmitted to it, the receiver operates two relays which in turn apply ground to two of the five code leads 1 to 5.

Before transmission is to take place over leads 1 to 5 of any two-out-of-five ground signals for registration of a digit represented by said signals on digit registers, a "steering" relay TR1 is operated by closure of an operating circuit therefor over lead 20. As soon as relay TR1 is operated, other "steering" relays such as TR2, TR3, TR4, etc. to TRN (not shown) are operated successively in sequence as fully described in said Hecht et al. patent. Each "steering" relay, such as TR1, corresponds to a digit register, such as 10, and arranged in circuit such that when all preceding "steering" relays are released the next one will connect the five code leads 1 to 5 to the operate windings of the five register relays of the associated register. For relays TR1 and register 10 as shown in Fig. 1, code leads 1 to 5 are connected respectively to armatures 1 to 5 of relay TR1 and, when relay TR1 is released, are extended by means of back contacts of said relay TR1 to leads 11, 22, 33, 44 and 55 "To armatures of next steering relay." When relay TR1 operates the code leads 1 to 5 are connected by front contacts of relay TR1 to the operate windings of respective register relays 12, 13, 14, 15 and 16 of the first digit register 10. Then when relay TR1 releases these code leads 1 to 5 are transferred by the respective armatures of relay TR1 to the next steering relay TR2 (not shown). When first operated, as above, all "steering" relays are locked operated. Relay TR1 locks operated over its inner left armature and front contact and lead 21 to ground. After the establishment of the holding path over lead 21 connection 20 is opened prior to transmission of coded information over leads 1 to 5. A more complete description of the above circuit functioning can be obtained by reference to the aforementioned Hecht et al. patent.

In the circuit application of Fig. 1 the two-out-of-five signals are checked before transmission to insure that two, no more and no less, out of five signals are to be transmitted. If the information to be transmitted is checked as improper a recorder signal is effective to require a fresh receipt of the particular code represented by the improper signal. If the signals to be transmitted are checked as satisfactory, then two of the code

leads 1 to 5 are momentarily grounded, say leads 1 and 5. With code leads 1 and 5 grounded and relay TR1 operated register relays 12 and 16 will be operated over circuits from batteries 19 and 23, lower operating windings of relays 12 and 16, leads 17 and 18 respectively, right-hand front contacts and operated armatures 1 and 5 of relay TR1 to ground over code leads 1 and 5. Register relays 12 and 16 will lock operated over circuits extending from batteries 19 and 23, upper hold windings of relays 12 and 16, upper front contacts of relays 12 and 16, common lead 24 and left outer front contact and armature 25 of relay TR1 to ground through the right operate winding of polar relay TO. If two or more hold windings of register relays are in parallel with common lead 24 there will be sufficient current in the latter traced circuit to operate relay TO. If relay TO does not operate, a reorder signal is again effective to cause reregistration. However, it will be assumed that register relays 12 and 16 lock operated and relay TO operates.

The operation of polar relay TO indicates completion of registration of information in first digit register 10. The operation of relay TO effects the opening of lead 21 to permit relay TR1 to release. Relay TR1 in releasing opens, at its left outer front contact and operated armature 25, the operating circuit for relay TO and at the same time substitutes, by means of a make-before-break contact arrangement, a normally made ground 26 for the ground on the opposite side of relay TO in order to provide the holding windings of relays 12 and 16 with a holding circuit. The release of relay TR1, as previously outlined, transfers code leads 1 to 5 to the armatures of the next steering relay, such as TR2 (not shown). The release of relay TO prepares the other parts of the circuit (not shown) for registration in a second digit register (not shown) of two-out-of-five information representing the second digit to be registered.

A more detailed description of the above-described circuit may be obtained by reference to the previously mentioned Hecht et al. patent. It will, of course, be appreciated that at such time as the marker is ready to determine the registered information it does so by checking which register relays have been operated and locked in each register. The marker may acquire the registered information on a two-out-of-five basis by recognizing ground as applied to leads 27 by operated register relays.

In Fig. 2 is shown a registration circuit which may be substituted for that of Fig. 1 in such a circuit as disclosed by the above Hecht et al. patent and which functions similarly to the circuit of Fig. 1 except as indicated hereinafter. Fig. 2 discloses the present invention in one of its preferred forms. It is to be noticed that the register relays 12 to 16 of Fig. 2 are single winding relays. It will be appreciated from subsequent description that the use of a unidirectional circuit element, such as copper-oxide rectifier 28, is to a great extent responsible, due to its peculiar location among cooperating parts of the circuit, for the ability of the circuit of Fig. 2 to perform all of the functions of Fig. 1 and more, while being faster, more comprehensive and more economical.

The operation of the circuit of Fig. 2 is the same as that of Fig. 1 except for certain improvements and refinements. A two-out-of-five checking circuit 29 has been added to contacts of the register relays 12 to 16. This arrange-

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ment of contacts has been used previously and is known to provide an electrical path therethrough only when two, no more and no less, relays have been operated at the same time. The use of such an arrangement obviates the necessity of using a polar relay as a check on the number of register relays operated. Therefore a neutral relay N may be substituted for polar relay TO of Fig. 1. The check circuit 29 must provide a locking path for the particular register relays which become operated and so provides a comprehensive check in that relay N will not operate unless two and only two register relays are operated and locked operated. The use of single winding relays as register relays 12 to 16 requires the presence of an asymmetrical resistance 28 so disposed in the holding or locking common lead 24 that the signal grounds momentarily transmitted over code leads 1 to 5 to windings of register relays, such as 12 and 16, cannot inadvertently operate check relay N in possible paths over upper operated armatures and front contacts of such register relays. The copper-oxide rectifier element 28, which, of course, could be any suitable asymmetrical resistance element, is so poled that it presents a high resistance to flow of current through the winding of relay N over a path completed to ground on side 30 of rectifier 28 but is so poled as to present low resistance to the holding circuits of register relays 12 to 16 when completed to ground on side 31 of rectifier 28.

There are many applications of the registration system or circuit invention exemplified by Fig. 2. Since a fully comprehensive check is obtained within the registration circuit the aforementioned checking of two-out-of-five frequencies in the Hecht et al. patent might not be necessary. Similarly, although the Hecht et al. disclosure has been referred to as an example of the substitution possibilities of the present invention, it is obvious that the present invention can be used in other systems as shown or in rearranged forms fully within its scope. Likewise a different number of register relays could be employed in conjunction with a different checking circuit through the contact lattice of such relays.

In regard to element 28, disclosed as an asymmetrical resistance such as a copper-oxide rectifier, it is, of course, possible and practical to utilize any means for such element which is responsive to polarity of voltage so as to conduct in one direction but not in the other. There are many electronic discharge devices which could fall within that qualification and which would operate very satisfactorily for the purpose set forth above. For instance, a unidirectional voltage responsive gas tube of the rectifying type or otherwise could be employed. It is well known that such tubes will conduct under the correct polarity and magnitude of voltage but will not conduct upon a reversal of polarity or will be extinguished by a reversal or a withdrawal of such voltage. The full import of the present invention contemplates any such unidirectional device, whether an asymmetrical resistance such as a copper-oxide rectifier or an electronic discharge device such as a hot-cathode gas diode, or like elements. It may be necessary, due to voltage drops in such unilateral or unidirectional devices or elements or due to higher voltages being necessary for conduction therethrough as compared to the operating paths of the register relays, to insert resistance in the operating leads, such as 17 and 18, to limit operating current

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when batteries, such as 19 and 23, must be larger than normally required in relay operating circuits. When asymmetrical resistances, such as copper-oxide rectifier 28, are used it is not considered necessary to provide such higher voltages. However, the use of comparable devices, such as gas tubes, adds the requirement, generally, of higher voltage ranges.

Since the present invention is not necessarily to be limited to the exemplary disclosure thereof set forth herein, and since those skilled in the art may produce rearrangements of the invention as a result of this disclosure, claims are appended which alone define the scope of said invention.

What is claimed is:

1. A registration system comprising a plurality of register relays, each relay provided with a single energizing winding and contacts, signaling means effective to energize momentarily and simultaneously a desired group of said windings, one group per registration and consisting of at least one winding, indicating means for indicating whether said desired group of windings has been energized, circuit means including contacts of said relays for controlling said indicating means, said contact inclusive means adapted to effect continued energization of said group of windings when said signaling means ceases to energize same, and circuit means for preventing said signaling means from controlling directly said indicating means.

2. A registration system comprising a plurality of register relays, each relay provided with a single energizing winding and contacts, signaling means effective to energize momentarily and simultaneously a desired group of said windings, one group per registration and consisting of at least one winding, indicating means for indicating whether said desired group of windings has been energized, circuit means including contacts of said relays for controlling said indicating means, said contact inclusive means adapted to effect continued energization of said group of windings when said signaling means ceases to energize same, and circuit means in circuit between said indicating means and said group of windings for preventing said signal leads from energizing directly said indicating means.

3. A registration system comprising a plurality of register relays, each relay provided with a single energizing winding and contacts, signaling means effective to energize momentarily and simultaneously a desired group of said windings, one group per registration and consisting of at least one winding, indicating means for indicating whether said desired group of windings has been energized, circuit means including contacts of said relays for controlling said indicating means, said contact inclusive means adapted to effect continued energization of said group of windings when said signaling means ceases to energize same, and a predominantly unidirectional circuit element in circuit between said indicating means and said energized group of windings and so polarized that said signaling means is ineffective to control directly said indicating means.

4. A registration system comprising a plurality of register relays, each relay provided with a single energizing winding and contacts, signaling means effective to energize momentarily and simultaneously a desired group of said windings, one group per registration and consisting of any desired plural number of said windings, indicat-

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ing means for indicating whether said desired number of windings has been energized, circuit means including contacts of all of said relays for controlling said indicating means, said contact inclusive means adapted to effect continued energization of said group of windings when said signaling means ceases to energize same, and an asymmetrical resistance in circuit between said indicating means and said energized number of windings and so polarized that said signaling means is ineffective to control directly said indicating means.

5. A registration system comprising a plurality of register relays, each relay provided with a single energizing winding and contacts, signaling means, a signal lead for each winding and associated with said signaling means, said leads connectable simultaneously and momentarily to said windings to energize a desired combination of said windings in accordance with the information to be registered on said register relays by means of said signal leads, one combination of windings per registration and consisting of a plural number less than all of said windings, relay means energizable to indicate that said number of windings has been energized, circuit means including contacts of all of said register relays for controlling said relay means, said circuit means effective to continuously energize said number of windings when said signal leads are disconnected from said windings, and a resist-

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ance having widely different conductivity in opposite directions therethrough located in circuit between said relay means and said number of windings and so polarized that said signal leads are ineffective to energize directly said relay means prior to disconnection thereof from said windings.

6. A registration system comprising five register relays, each relay provided with a single energizing winding and contacts, signaling means, a signal lead for each winding and associated with said signaling means, said leads connectable simultaneously and momentarily to said windings to energize any two of said windings in accordance with the information to be registered on said register relays by means of said signal leads, a relay energizable to indicate that two windings have been energized, circuit means including contacts of all of said register relays for controlling said relay, said circuit means effective to continuously energize said two windings when said signal leads are disconnected from said windings, and a copper-oxide rectifier in circuit between said relay and said two windings and so polarized that said signal leads are ineffective to energize directly said relay prior to disconnection thereof from said windings.

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No references cited.