

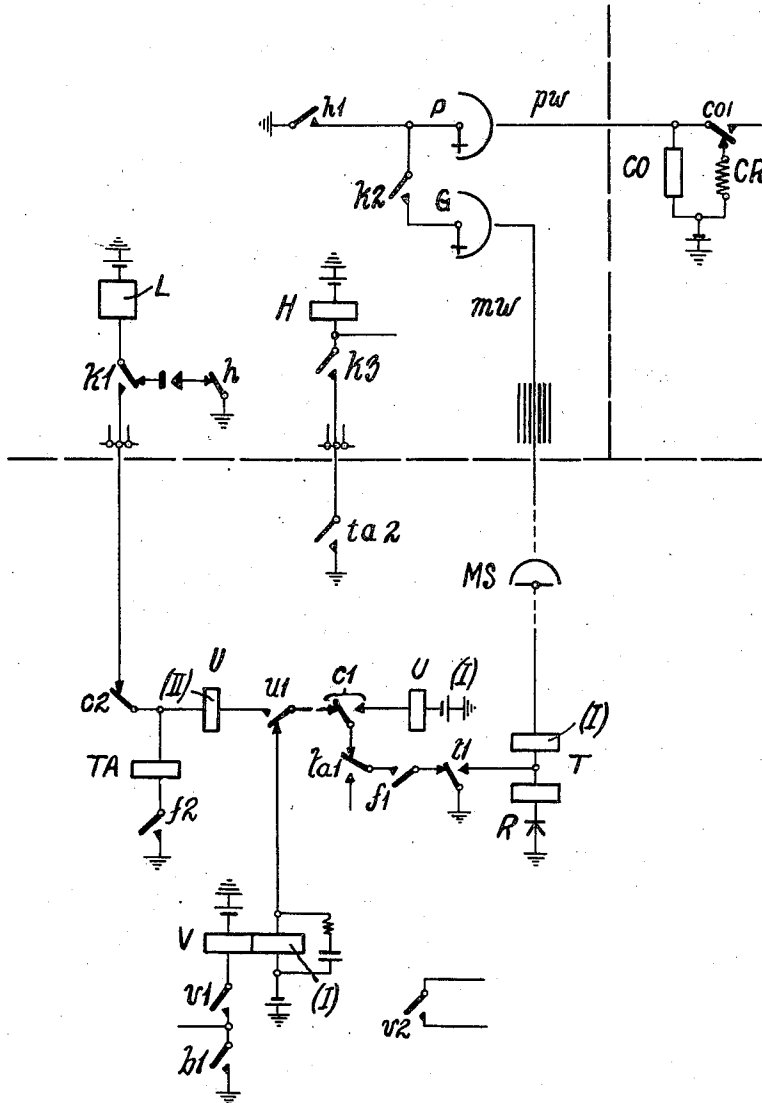
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ELECTRIC SELECTIVE SYSTEM

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ELECTRIC SELECTIVE SYSTEM

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This invention relates to electric selective systems and has in view improved arrangements for the determination, by an outgoing or selecting circuit of the nature of an incoming or selected circuit to which latter the former may have become connected. It is useful in those cases in which a selecting device is required to bring about different operations or itself to operate in different manners according to the nature of the incoming circuit to which it may have become connected.

The terms outgoing and incoming are used for convenience and imply, respectively, where the context permits or requires, any suitable active circuit which is adapted to become connected with any suitable passive circuit.

In one aspect of the invention, the determination of the nature of an incoming circuit is effected by arranging that of two apparatus, one in the outgoing circuit and one in the incoming circuit, the order of their operation shall depend upon the nature of the incoming circuit. The two apparatus may conveniently consist of relays.

In another aspect of the invention, the determination of the nature of the incoming circuit is effected by arranging that the time, relatively to the time at which an apparatus in the outgoing circuit operates, at which a signal is transmitted from the incoming circuit to the outgoing circuit shall be characteristic of the nature of the incoming circuit. The signal, if transmitted in time, will be detected by an apparatus, which may be a relay, and, moreover, may be a high speed relay of the type disclosed in the patent of Ernest J. Gachet, No. 1,992,619, granted Feb. 26, 1935. If the signal is not transmitted in time, the operation of the apparatus in the outgoing circuit will have proceeded to such a stage that detection of the signal may be prevented, or that the effect of its detection may be annulled.

In certain applications of the invention, as for instance, its application to the telephone art, the determination of the nature of the incoming circuit (which may be a subscriber's line) is conveniently effected at the time at which the incoming circuit is taken into engagement by the outgoing circuit (which may be the final selector switch seizing the line), and, in such applications, the sensitive apparatus may be the relay which is used to test the idle or busy condition of the incoming circuit and the signal may be transmitted over the conductor over which that test is made. The apparatus in the incoming circuit may then be a relay in the test circuit and the differing natures of the incoming circuits may be

indicated by relays which require differing times for their operation. The invention will be described in connection with a system having these characteristics and, moreover, in connection with an automatic telephone system.

Further exemplary description may more conveniently be given with the aid of a diagram. Reference is therefore made to the accompanying drawing which shows certain parts of a final selector in a known system of automatic telephony and which illustrates the invention, the final selector may be of the general type shown in British Patent No. 412,722, accepted July 5, 1931.

In the system of automatic telephony to which the invention is regarded as being applied, the setting of a final selector to the contacts of a subscriber's line is effected under the control of an apparatus common to a number of final selectors which registers impulses characteristic of the line (but not of the nature of the line) into association with which the final selector is eventually to be brought, effects an electrical marking of a contact appropriate to the said line, and initiates and terminates a selective operation on the part of the final selector to bring the final selector into association with and to prevent its overrunning the said appropriate contact.

In the diagram, the apparatus indicated above the chain line is to be regarded as part of the final selector and of the exchange end of a subscriber's line circuit, and that below the chain line is to be regarded as part of the common controlling apparatus. The final selector and common control apparatus are the outgoing, and the subscriber's line circuit is the incoming circuit. Only those parts of these elements which are necessary to the understanding of the invention are shown.

It may be assumed that the common control apparatus becomes temporarily associated with the final selector upon the operation of a relay, not shown, but represented by three of its contacts *k1* to *k3*, that upon the completion of the reception, by the common control apparatus, of impulses representing a wanted line the switch indicated as MS will occupy a position indicative of the position to which the final selector shall move, that to this latter end the several contacts in the bank of switch MS are appropriately cross-connected to contacts in the bank G of the final selector, that the idle or busy condition of a wanted line is indicated by the potential applied to its contact in the bank P the idle condition being indicated by low resistance battery applied

to that contact, that the marking and test wires (*mw* and *pw*) of a line are connected to corresponding contacts in the two banks G and P, and that the wipers which engage these two banks move synchronously.

It may further be assumed that during the reception by the common control apparatus of the final train of impulses indicative of a wanted line, the three relays, not shown, represented respectively by their contacts *b1*, *c1* and *c2*, and *f1* and *f2* are operated so that the contacts occupy their positions alternative to those shown, that upon the completion of the reception of the final train of impulses the relay represented by its contacts *c1*, *c2* releases so that these contacts occupy the positions shown, that the relays represented by contacts *b1* and *f1*, *f2* remain operated, that, due to the simultaneous operation during the reception of impulses of the relays represented by contacts *f1* and *c1* a circuit is completed through winding (I) of relay U, and that when connection is established, relay H operates and at contact *h1* closes a holding circuit.

Upon the completed reception of the final train of impulses indicative of the wanted line, and upon the consequential release of the relay represented by contacts *c1* and *c2*, a circuit is completed from earth, by way of contacts *t1*, *f1*, *ta1*, *c1*, and *u1*, low resistance winding (II) of relay U, contacts *c2* and *k1*, and winding L of a latch magnet to battery. The latch magnet serves, upon operation, to remove a latch from the moving parts of the final selector and to close a circuit for a driving motor as may be understood or as is known in the art of automatic telephony. As a result of the closing of the above circuit relay U is held operated, relay TA is short circuited, the latch magnet is operated, and the final selector is driven in its search for the wanted line. As soon as the two wipers which respectively serve the two banks G and P encounter the contacts of the wanted line, a circuit becomes completed from earth, through rectifier R, windings of high speed relay T, wiper and contact of marking switch MS, contact and wiper G of the final selector, contact *k2*, wiper and contact *p* of the final selector, and winding of the cut-off relay CO shunted by contact *co1* and resistance CR, to battery. In this circuit both relay T and relay CO will operate, but the former, which has an operating speed of the order of one millisecond, will operate very much more quickly, in terms of the times of operation of relays, than will the latter. Relay T, at its contact *t1*, opens the circuit of the latch magnet L and of high speed relay U, both of which release and the former of which arrests the motion of the final selector.

When relay CO does operate, the impedance in the circuit of relay T is, owing to the removal of the shunt constituted by resistance CR from across the winding of relay CO, temporarily increased to such an extent that relay T cannot or may not hold. When the impedance in the circuit of relay T falls sufficiently, relay T, if it shall have released, will again operate.

The operations described above, except insofar as they involve relay U, relay TA, and the temporary release of relay T are those usual, under the conditions described, in a known system of automatic telephony.

At the moment at which relay T originally operated, that is, before its temporary release, the short circuit was removed from across relay TA an operating circuit for which therefore then

existed from earth, by way of contact *f2*, *c2*, *k1*, and latch magnet L to battery. Relay TA, but not magnet L operates in this circuit. The method of operating relay TA is immaterial to the invention and the method described is not claimed herein.

At the moment at which relay U released, following the operation of relay T and before its temporary release, and moreover before relay TA shall have operated in the circuit described in the preceding paragraph, a circuit, at present open at contact *t1*, is prepared from earth, by way of contacts *t1*, *f1*, *ta1*, *c1*, *u1*, winding (I) of relay V, to battery, for relay V. Whether or not this circuit shall be completed, that is whether or not relay V shall be given an opportunity to operate, will depend upon whether contact *t1* shall fall back, upon the temporary release of relay T, before contact *ta1* shall have had time to open the circuit or shall, if it fall back at all, fall back after that event. Relay V should preferably be a high speed relay.

For the purpose of the invention in the example of circuit under description, it is arranged that the speed of operation of relay TA remains constant, since this relay is associated with the active outgoing circuit, but that the speeds of operation of different relays CO, associated with different sorts of incoming circuits, the difference between which circuits it is desired that the outgoing circuit shall determine, are different. It has to be observed that the difference in the speeds of operation has to be such that, in some cases the relay CO concerned has to operate and relay T has to fall off before relay TA shall have operated so that relay V may operate, whilst in other cases the relay CO concerned has to operate so late with reference to the time at which relay TA operates that relay T, if it releases at all, is unable to complete the circuit of relay V so that this latter relay may not operate. Thus, in the example under description, the nature of incoming circuit with which the outgoing circuit has become connected is registered by the condition (operated or unoperated) of relay V which, at its contact *v1* closes a holding circuit for itself and at its contact *v2* may cause appropriate or prevent inappropriate operations.

Adjustment of the speeds at which different relays CO associated with different subscribers' lines operate may be effected by providing the different relays with alternative windings one producing a heavy and the other a light flux.

It remains to be observed that, in the system of automatic telephony in connection with which it has been found convenient to describe the invention, the normal immediate method of preventing intrusion, by a second final selector, upon a line which is already engaged by a first final selector, is by connecting earth, from contact *t1*, through the comparatively low resistance winding (I) of relay T, to the contact in banks G and P of the wanted line, so that the potential thereon is brought so near to earth potential that a second relay T associated with the second final selector the contacts of which are multiplied to those of that shown, is unable to operate to arrest the motion of the second final selector; and that there is a period, during the temporary release of relay T, when this low resistance earth is not applied. Intrusion is, however, none the less prevented during the time that relay T is released for, as will be appreciated, as it was the increased impedance upon the operation of relay CO in the circuit of relay T which brought about the

temporary release of relay T, so that the same increased impedance will prohibit the operation of a second relay T. Even should the second relay T associated with the second final selector be applied to the multiplied contact at the moment when the impedance in the circuit of the relay T shown shall have adjusted itself to that value at which the shown relay T can operate, the second relay T will not operate because it will, on account of the great speed at which the second final selector passes off the contact, be applied to the said multiplied contact for an insufficient time. The difference between the conditions which obtain when the second relay T might be applied at the moment mentioned in the preceding sentence and which prohibit the operation of the said second relay, and those which obtained when the first relay T was applied and which did not prohibit the operation of the said first relay although the durations of their respective applications are, so far as may be, the same, is that, in the case of the application of the second relay T, relay CO is not, whereas in the case of the application of the first relay T it is, shunted by the resistance CR.

The use of a rectifier in series with relay T forms no part of the invention and is not claimed herein.

Storage means may be provided whereby a plurality of signals may be received for discriminating between a plurality of different incoming circuits. For instance, by arranging contact *ta* as a change over contact and by associating a relay similar to relay V with the front contact *ta*, the nature of both of two incoming circuits can be positively registered. In this case the second relay V would be guarded by a contact on relay V so that it should not operate when, eventually, relay T releases.

I claim:—

1. In a selective signaling system, a plurality of incoming circuits, a connecting circuit having means for testing said incoming circuits and determining the condition thereof, said testing means including an apparatus in the incoming circuit and another in the connecting circuit, the condition of the incoming circuit determining the sequence of operation of the apparatus in the incoming circuit and that in the connecting circuit, and means in the connecting circuit controlled by the sequence of operation of said apparatus.

2. In an electric selective system, a plurality of incoming circuits capable of having different conditions existing therein, an outgoing circuit having means for connecting with and testing said incoming circuits, said testing means including a test element, said test element operating within a predetermined time after connecting with an incoming line if one condition exists thereon to indicate that condition and indicating another condition if not operated within that predetermined time.

3. In an electric selective system, an outgoing circuit, a plurality of incoming circuits of different natures, means for connecting outgoing circuits with said incoming circuits for testing, means in the incoming circuits for sending a signal back to the outgoing circuit at predetermined times dependent upon the nature of the incoming circuit, and means in the outgoing circuits for determining the nature of the incoming circuit de-

pendent upon the time after seizure when said signal is sent back.

4. In an electric selective system in which an outgoing circuit is adapted to be connected with incoming circuits of different natures, testing device in the outgoing circuit having means operated in one manner when an incoming circuit is connected with, other means controlled by said first means, said first means then operated in another manner either before or after the said other means is operated, the time of the second operation of said first means determining the nature of the incoming line connected with.

5. In an electric selective system in which an outgoing circuit is adapted to be connected with incoming circuits of different characters, a high-speed relay in the outgoing circuit, a second relay, means for operating the high-speed relay whenever an incoming circuit is connected with, means controlled by the operation of said high-speed relay for operating said second relay, and means for then releasing the high-speed relay either before or after the said second relay operates depending upon the character of the incoming circuit connected with.

6. In a selective system, a plurality of lines of different character, test circuits for each line, means in said lines for increasing the impedance of their test circuits at different times, a selector for connecting with and testing said lines, a test relay in the selector operated when the selector seizes a line, a circuit prepared by said relay, another relay controlled by said test relay, means controlled by said other relay for opening the prepared circuit, a relay in said prepared circuit operated when the selector is connected with a line which increases its impedance at one time and prevented from operating by the operation of said other relay when the selector connects with a line which increases its impedance at a later time.

7. In a selective system, a plurality of lines, relays of one speed on certain of said lines and relays of another speed on other of said lines, a selector for connecting with and testing said lines, means in the selector for closing a test circuit including the relay of the line connected with, means responsive to the operation of the relay of the line for sending a signal back to the selector, means in the selector connected for operation for an interval only, and means for operating said last means only when the signal sent back by the relay of a connected line is of a certain speed.

8. In a telephone system, a plurality of lines of different character, a selector switch for connecting with and testing said lines to determine the character thereof, a cut-off relay for each line, certain of said relays operating at different speeds, a test relay in the selector, a circuit closed when a line is seized including said test relay and the cut-off relay of the line connected with, said relays operated in said circuit, said cut-off relay when operated changing the resistance of said test circuit to temporarily release the test relay and re-energize it, the release of the test relay being dependent upon the speed of operation of the cut-off relay, and means in the selector operated if the test relay falls back at one time and prevented from operating if it falls back at an earlier time.

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