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CIRCUIT-ARRANGEMENT FOR USE IN AUTOMATIC SIGNALING SYSTEMS FOR THE NUMERICAL ADJUSTMENT OF A FINAL SELECTOR UNDER THE CONTROL OF PULSES

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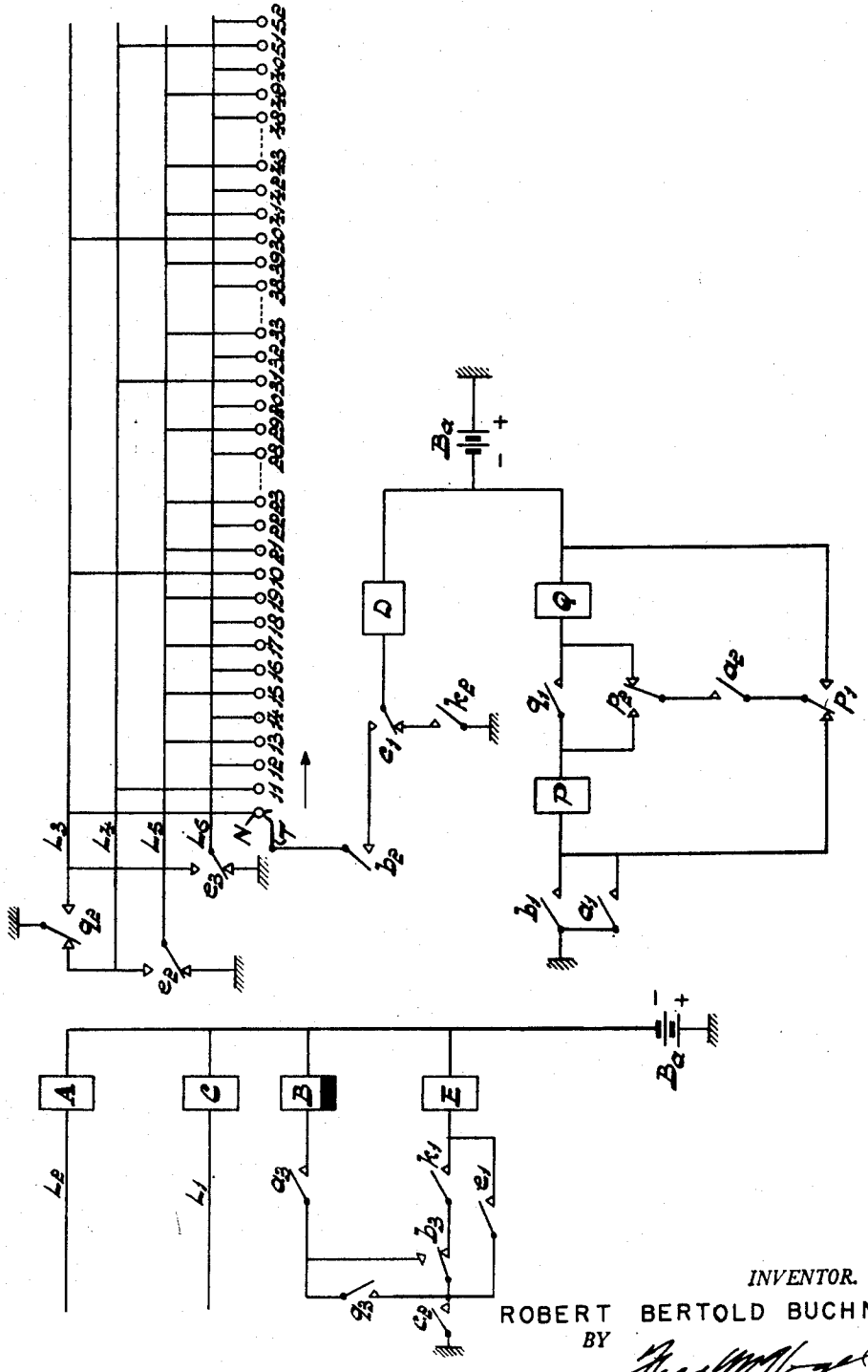

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CIRCUIT-ARRANGEMENT FOR USE IN AUTOMATIC SIGNALING SYSTEMS FOR THE NUMERICAL ADJUSTMENT OF A FINAL SELECTOR UNDER THE CONTROL OF PULSES

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The invention relates to circuit-arrangements for use in automatic signalling systems, for example automatic telephone systems, for the numerical setting of a single motion final selector having a fixed rest position, under the control of pulses.

A circuit-arrangement for the setting of a switch is known, in which the switch comprises two groups of individual test contacts, i. e. test contacts not connected to corresponding contacts of other switches, and in which each contact of one group are arranged between contacts of the other group in the contact bank. Under the control of dialling pulses, pulse contact supplies a start criterion and a stop criterion alternately to the contacts of one group and to those of the other group, any further contacts provided being supplied with a start criterion. Through a test wiper, the control device of the switch tests the nature of the criteria and causes the switch to stop when the wiper reaches a test contact having a stop criterion and causes it to move on when a test contact is supplied with a start criterion.

In the rest position of the selector, the rest test contact has a stop criterion. Upon the reception of the first pulse the criteria are interchanged and the selector moves on until a test contact of the other group now having a stop criterion is found. On receiving the second pulse, the pulse contact again changes over, so that the contact at which the selector is stopped is supplied with a start criterion and the selector moves on until a contact of the first group, now having a stop criterion, is reached. Consequently, the circuit-arrangement may be said to operate as an electrical escapement.

The stop criterion may, for example, consist in the presence of voltage at a test contact, whereas a contact having a start criterion has no voltage, i. e., is not connected to a voltage source. Conversely, the absence of voltage may be indicative of the stop criterion and the presence of voltage indicative of the start criterion.

The use of an electrical escapement permits the use of single motion switches which are simpler and cheaper than two-motion switches, while registers or separate setting switches are not needed. Since the spaces between the contacts at which the selector is stopped after a pulse series may be varied within wide limits, the numerical groups may be very different from each other.

The aforesaid principle may be used not only for the setting of group selectors but also of final selectors. A known circuit-arrangement utilizes an electrical escapement in a final selector only for setting to a wanted decade (groups of tens). During setting to the desired outlet within the decade, the switch operates as a step-by-step switch, so that the circuit-arrangement cannot be used in combination with centrally driven switches.

Switches, adapted to operate as step-by-step switches with self-interruption contacts have a limitation in that they are slow in operation, so that the reliability of setting is seriously affected if attempts are made to increase the speed of operation.

The object of the invention is to provide a circuit-arrangement in which, both the decade setting and the setting to the wanted outlet are effected with the aid of an electrical escapement. In this circuit-arrangement all the outlets of the selector may, in principle, be utilized to advantage so that intermediate auxiliary test contacts

to which an outgoing line cannot be connected may be dispensed with.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying diagrammatic drawing, given by way of example, in which one embodiment of the circuit-arrangement according to the invention is represented.

The drawing shows a circuit-arrangement for the setting of a final selector with the use of an electrical escapement, in which marking is tested directly by the rotary magnet of the switch and the start and stop criteria are formed by the connection and disconnection respectively of the relative test contacts to a battery.

The drawing only shows those elements which are necessary for a good understanding of the invention.

Of the contact bank of the switch only part of the escapement is shown, over which the test wiper T, passes and which has contacts N, **11**, **12** and so on. The other contacts and wipers of the switch, such as the contacts and wipers through which a speech connection is established, or by means of which the busy marking for the various outlets takes place, and the means for testing the busy marking are omitted in drawing for the sake of simplicity.

The test contacts of the escapement, in contradistinction to other contacts of the switch, are not multiplied to corresponding contacts of other final selectors.

In the rest position of the switch, the wiper T engages the contact N. If the rotary magnet D is energised, the wiper T wipes over the test contacts in the direction of the arrow.

The contacts **11**, **21**, and so on correspond with the outlets of the switch having the same units digit. The contacts **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19** and **10** correspond with outlets of the first decade, the contacts **21** to **20** with outlets of the second decade, and so on.

The rest contact N and the last contacts (**10**, **30**, **50**, **70**, **90**) of the odd numbered decades are connected to a line L_3. The make contact p_3 of a relay P is connected between the line L_3 and earth.

The first contacts (**11**, **31**, **51**, **71**, **91**) of the odd numbered decades are connected to a line L_4. Rest contact p_3 is connected between the line L_4 and earth.

Of the remaining contacts of the escapement, contacts having an odd numbered units digit, contacts **13**, **15**, **17**, **19**, **21** and so on, are connected to a line L_5, whereas the contacts having an even numbered units digit, contacts **12**, **14**, and so on, are connected to a line L_6. Contacts of any non-numerical outlets, such as contacts corresponding with lines associated with a P. B. X-group, which contacts are not shown in the drawing, are connected directly to earth.

If the relay E is not energized the lines L_5 and L_6 are earthed through rest contacts e_2 and e_3 of relay E. If the relay E is energized, the line L_5 is connected through make contact e_2 to the line L_4, and the line L_6 is connected to the line L_3 through make contact e_3.

The circuit-arrangement operates as follows:

When the final selector is engaged by a group selector in a preceding stage, busy relay C is energized through line L_1. The relay C prepares through its make contact c_1 an energizing circuit for the rotary magnet D. By closing the make contact c_2, an energizing circuit for relay E is prepared in series with rest contact b_3 of relay B and make contact k_1 of the switch. Relay E is not energized in this circuit, since contact k_1 is open in the rest position of the switch.

The dialling pulses are supplied through line L_2 to the pulse receiving relay A, which is thus energized upon each pulse of the tens series and of the units series. Upon the reception of the first tens pulse by relay A, make contacts a_1 and a_2 of this relay are closed and relay Q is energized in the circuit from earth through make contact a_1, rest contact p_1 of relay P, make contact a_2 of relay A, rest contact p_2 of relay P, winding of relay Q and through battery Ba back to earth.

Relay Q completes, through its make contact q_1 a holding circuit for itself in series with the winding of relay P. Relay P, however, is not energized, since its

winding is short-circuited through make contact q_1, rest contact p_2, make contact a_2 and rest contact p_1.

Energisation of relay Q causes the relay B to become energized through make contact c_2 of relay C, make contact q_3 of relay Q and make contact a_3 of relay A. Relay B is thus energized subsequently to relay Q. Naturally, as an alternative, this effect may be obtained directly by providing that relay B responds more slowly than relay Q. Relay B closes its make contact b_1 in parallel with the make contact a_1 of relay A and its make contact b_3 in parallel with make contact q_3 of relay Q.

Relay B de-energizes slowly, so that its contacts are held operated during the period between two pulses of the same series and is re-energised by the following pulse.

At the end of the first pulse, relay A is de-energised, so that owing to the opening of make contact a_2, the short-circuit of relay P is interrupted and relay P is energized in a circuit from earth through make contact b_1, the winding of relay P, make contact q_1, the winding of relay Q to the battery Ba.

Relay P changes over contacts p_1 and p_2 into the make position.

At the beginning of the following pulse, relay Q is de-energized, since its winding is short-circuited through make contacts q_1, p_2, a_2 and p_1 upon closure of make contact a_2 of relay A. Relay P, however, is held energized in the circuit from earth through make contact b_1, winding of relay P, make contact p_2, make contact a_2, make contact p_1 to battery Ba until this circuit is interrupted at make contact a_2 upon de-energisation of relay A at the end of the second pulse.

The relay arrangement P, Q, thus resumes its initial position after two pulses. The co-operation described is repeated on receiving following pulses of the same series. At the beginning of each odd numbered pulse the relay Q is thus energized and at the beginning of each even numbered pulse, the relay Q is again de-energized. The relay arrangement P, Q consequently operates as a pulse-halving circuit.

Since the relays Q and B are energised at the beginning of the first pulse of the tens series, the rotary magnet D is energised in the circuit from earth through make contact q_2 of relay Q, line L_3, rest contact N, wiper T, make contact b_2 of relay B, make contact c_1, the winding of the rotary magnet D to battery Ba.

The switch is actuated and the wiper T leaves the rest position N, the switch closing its make contacts k_1 and k_2. Relay E, however, is not energised, since the rest contact b_3 is open.

The wiper T stops upon reaching the test contact **11**, since at this instance this contact is not earthed and the energizing circuit of the rotary magnet D is thus interrupted. Contact **11** is the first contact of the first decade.

Upon reception of the second pulse of the tens series, the relay Q is de-energised, as stated above, and closes its rest contact q_2, so that the rotary magnet D is again energized in a circuit from earth through rest contact q_2, line L_4, test contact **11**, wiper T, make contacts b_2 and c_1, the winding of the rotary magnet D, through the battery Ba and back to earth.

The switch now moves on and passes by the outlets **12** to **19** of the first decade, the test contacts of which are earthed through rest contact e_2 or rest contact e_3. The selector stops when the outlet **10** is reached, i. e. the last of the first decade, the test contact of which is not earthed, since the make contact q_2 is open.

It will now be assumed that the outlet to be chosen has the number **23**.

After the second pulse of the tens series no further pulses of this series follow and make contact a_3 remains open during a period which exceeds the time of de-energisation of relay B. Relay B is released and opens its make contacts b_1 and b_2 which, in the present case, has no immediate effect since both the rotary magnet D and the relays P and Q are de-energised. Owing to the closure of rest contact b_3, relay E is energised in a circuit from earth through make contact c_2, rest contact b_3, make contact k_1, the winding of relay E to battery Ba.

Relay E completes a holding circuit for itself through its make contact e_1, independently of rest contact b_3 and changes over the contacts e_2 and e_3 into the make position.

On reception of the first pulse of the units series relays A, Q and B are energised in a manner entirely similar to that at the beginning of the tens pulse series.

Relay B is held energised during the units pulse series. The make contact q_2 closes, so that the rotary magnet D is energised through make contact q_2, line L_3, test contact **10**, wiper T and make contacts b_2 and c_1.

The selector moves to the outlet **21** i. e. the first outlet of the second decade. At the second units pulse, relay Q is de-energised and the contact **21** is earthed through rest contact q_2, make contact e_2 and the selector moves to the outlet **22**.

At the third units pulse, relay Q is again energised and test contact **22** is earthed through make contacts q_2 and e_3 and the selector moves to the desired outlet **23**.

Since no further units pulses follow, relay B is de-energised and means (not shown) are actuated to test the busy condition of the wanted outlet.

After the termination of the call, the relay C is released, so that relay E is also de-energised. The rotary magnet D is now energised in a circuit from earth through make contact k_2 of the switch and rest contact e, of relay C, the winding of the rotary magnet D and the battery Ba. The switch moves on until, on reaching the rest position, the make contact k_2 opens and the rotary magnet D is de-energised.

It will now be assumed that the selector is to be set to the outlet **33**, so that in this case the tens series consists of three pulses.

As described above, the selector moves to the outlet **10** after the second tens pulse. The relays Q and E are then de-energised and the test contact **10** is not earthed.

At the third tens pulse, the relay Q is energised and test contact **10** is earthed through make contact q_2 and line L_3.

The selector now leaves the outlet **10**, passes by all the outlets of the second decade and stops when the first outlet (**31**) of the third decade is reached.

In general, if the number of pulses of the tens series is odd, the selector will finally stop at the first contact of the corresponding decade and, if this number is even, at the last contact of the decade preceding the wanted decade.

Since in the case under view no further tens pulses follow after the third tens pulse, relay B is released, so that relay E is again energised through make contact c_2, rest contact b_3 and make contact k_1.

Furthermore, owing to the opening of make contact b_1, the relays P and Q are de-energised. Make contact b_2, however, opens before rest contact q_2 closes, so that the rotary magnet D is not energised.

At the first pulse of the next following units series, first the relay Q and then relay B are energised, owing to energisation of relay A in the manner described above. The break contact q_2 is thus opened before make contact b_2 closes. In consequence, the rotary magnet D is not energised and the selector stops at the outlet **31** after the first units pulse.

At the second units pulse the relay Q is de-energised and test contact **31** is earthed through the rest contact q_2 and the line L_4, the selector moving to the outlet **32**.

At the third units pulse the relay Q is again energised and connects the test contact **32** to earth through make contact q_2, make contact e_3 and line L_6. The selector now moves to the desired outlet **33**, whereupon relay B is de-energised and the busy marking of the outlet is tested through a test wiper (not shown) of the switch.

The start criterion may, as an alternative, be indicated by connecting the relative test contacts to earth or to a battery: in this case the start-stop criteria should be tested by means of a separate test relay, instead of being tested directly by means of the rotary magnet, this separate test relay controlling in turn the rotary magnet in a circuit comprising a rest contact of the separate test relay and a contact which is closed after the criteria have been interchanged for the first time at the beginning of a pulse series.

The pulse-halving circuit comprising relays P and Q may be included with advantage in the connecting circuit or in a register instead of being included in the selector, so that this circuit-arrangement may be used not only for controlling the group selectors but also for controlling the final selector.

Moreover, instead of using the pulse-halving circuit-

arrangement described, any other suitable circuit-arrangement may be used.

What I claim is:

1. In an automatic signalling system, a switching circuit arrangement under the control of dial pulses in a tens and a units pulse series, said arrangement comprising a single motion final selector having a fixed rest position, a succession of test contacts, a test wiper for said contacts, and a rotary magnet for actuating said wiper successively to engage said contacts, the contacts to which the wiper is advanced after a tens pulse series being divided into two groups, the contacts of one group being disposed alternately with respect to contacts of the other group, relay means responsive to said dial pulses during a tens pulse series for supplying to the contacts of said one group a stop criterion having a potential value to effect deactivation of said magnet and supplying to the contacts of said other group a start criterion having a potential value to effect activation of said magnet, and for interchanging the criteria for each succeeding tens pulse series, relay means responsive to said dial pulses during a tens pulse series for supplying a start criterion to any contacts intermediate the contacts of said groups, a control device connected to said test wiper and coupled to said rotary magnet for deactivating said wiper and arresting said selector when said test wiper reaches a contact having a stop criterion and for activating said wiper and causing the selector to move on

when reaching a contact bearing a start criterion, the contacts in said succession thereof being arranged whereby the first contact of each odd numbered decade has a stop criterion after each odd numbered tens pulse and a start criterion after each even numbered tens pulse, and the last contact of each even decade has a start criterion after each odd numbered tens pulse and a stop criterion after each even numbered tens pulse, whereas the remaining test contacts have a start criterion during a series of tens pulses, and the odd numbered contacts of each decade have a stop criterion after each odd numbered units pulse and a start criterion after each even numbered units pulse, and in that the even contacts of each decade have a start criterion after each odd numbered units pulse and a stop criterion after each even numbered units pulse.

2. A switching circuit arrangement, as set forth in claim 1, further including an energization circuit for said rotary magnet, said energization circuit including a normally open contact, and means responsive only after the beginning of a pulse series for closing said contact.

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