

Nov. 20, 1945.

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2,389,564

ELECTRICAL SYSTEM

Filed Oct. 28, 1944

FIG. 1.

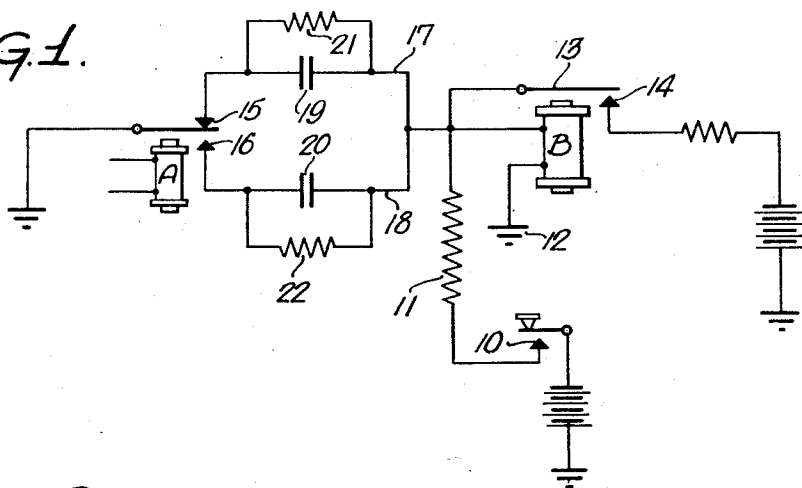


FIG. 2.

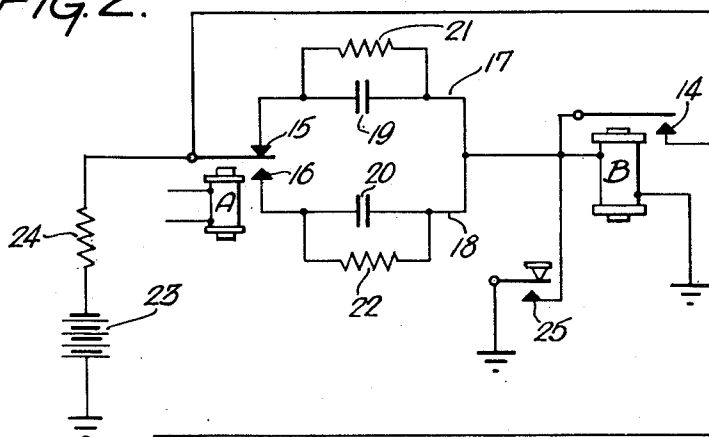
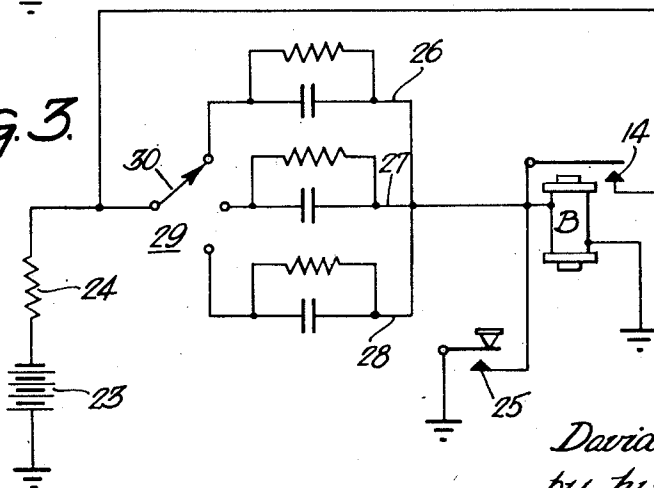


FIG. 3.



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2,389,564

ELECTRICAL SYSTEM

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Application October 28, 1944, Serial No. 560,876

11 Claims. (Cl. 175-320)

This invention relates to electrical control systems and has for its primary object to accomplish certain operational sequences with a minimum of equipment or, in any event, with less costly equipment than would otherwise be required.

That embodiment of the invention, hereinafter described, which has actually been put to use, forms a component portion of an automatic system for calibrating radio signal generators; but it is susceptible of being utilized profitably in other systems where similar operational sequence are required to be preformed.

The two additional embodiments shown in the drawing and described hereinafter have been included for the purpose of illustrating some of the practicable modifications within the scope and purview of my inventive concept, and which can usefully be resorted to whenever the need may arise.

Referring to the drawing:

Fig. 1 is a circuit diagram of a component portion of an automatic calibration system and illustrates an embodiment of the invention which is now in commercial use;

Fig. 2 is a circuit diagram illustrating an arrangement which is basically identical with that of Fig. 1, but modified to meet a different operational requirement; and

Fig. 3 is a circuit diagram illustrating an arrangement which is fundamentally like that of Fig. 2, but entailing certain changes which may, in appropriate circumstances, advantageously be adopted.

In Fig. 1 there are shown two electric relays designated A and B, respectively. The prescribed requirement with respect to the functioning of Fig. 1 is that any operation of relay A, whether actuation or deactuation, must cause de-energization of relay B—pre-existing energization of the latter being postulated.

There are several ways outside the scope of this invention by which the aforesaid result can be accomplished; but so far as I am aware, all such solutions of the problem involve either more or costlier equipment than does the arrangement of Fig. 1.

Initial actuation of relay B is effected by closing a contact 10, which completes a circuit from a source of current through resistance 11 and the winding of relay B to ground at 12. Contact 10 is closed momentarily at intervals and may be actuated either manually, mechanically, or electrically.

When relay B is energized as a result of clo-

sure of contact 10 it pulls up its armature 13 and closes a contact 14 which completes a locking circuit through the winding of said relay. Thus, relay B is kept energized irrespective of the subsequent operation of contact 10 and remains energized pending a subsequent operation of relay A. And, as will presently be seen, it makes no difference whether the aforementioned subsequent operation of relay A is an actuation or deactuation thereof. That is to say, de-energization of relay B will result whether relay A pulls up or releases.

It will be observed that relay A has a back contact 15, shown closed, and a front contact 16, shown open; and each of said contacts is included, individually, in one of two parallel branch paths 17 and 18, including, respectively, condensers 19 and 20. Condenser 19 is shunted by a high leakage resistance 21, and condenser 20 is similarly shunted by a high leakage resistance 22. It is possible to employ leaky condensers and thus eliminate resistors 21 and 22, but that is not considered good practice.

If contact 10 is closed, with contact 15 also closed, condenser 19 will be charged, first by way of resistance 11 and then via contact 14, which closes immediately after closure of contact 10. Subsequently, upon opening of contact 15, condenser 19 discharges through resistor 21. Meanwhile, condenser 20 is without a charge—having been fully discharged through its shunt resistor 22. Hence, upon closure of contact 16, brought about by energization of relay A, a flow of current into condenser 20, via contact 14, will cause a momentary diversion of current away from the winding of relay B—which diversion is sufficient to effect de-energization of relay B. The consequent opening of contact 14 causes relay B to remain de-energized until contact 10 is again closed.

Following the actuation of relay A and the resultant opening of contact 15, condenser 19 discharges through its shunt resistor 21, just as condenser 20 had previously done while contact 16 was open. Hence, as will now be apparent, if relay B is again actuated by closure of contact 10, it will, in turn, become deactuated upon de-energization of relay A and the resultant closure of contact 15.

Manifestly, it is not of the essence of this invention that contacts 15 and 16 be electromagnetically actuated. They could as well be manually or mechanically actuated; and it should be apparent that there may be substituted in place of relay B any electrical device, such as an elec-

tromagnetic step-by-step switch or an electric motor, or an electric heating element, provided such substituted device is operative, upon energization, to bring about closure of a locking circuit, and is capable of opening such circuit upon de-energization.

It is to be understood that the element designated as relay B would ordinarily be equipped with additional contacts, not shown, for controlling one or more auxiliary circuits. But such a provision is, of course, not applicable unless the element in question is in fact a relay.

As will be evident, relay B can be energized by manually or mechanically closing contacts 14, thus permitting elimination of contact 10; but usually contact 10 is located at a remote point and is, for that reason, needed.

The capacity requirements as respects condensers 19 and 20 obviously depend to a large extent upon the impedance of the winding of relay B. Generally these requirements are not critical except that the capacities must be large enough to bring about a decrease of the voltage across the relay winding of such degree and for a long enough time to insure the opening of contact 14. Preferably these capacities should not be substantially greater than is found necessary in each specific case. Leakage resistances 21 and 22 should be high enough to avoid excessive shorting of the condensers, but low enough to insure that the condensers will discharge adequately within whatever period of time may be allowable. The period, obviously, is a function of the frequency of operation of relay A.

In some cases it may be desirable to energize relay B in response to each operation of relay A, instead of de-energizing it in response to each such operation; and Fig. 2 illustrates a modification of Fig. 1 designed to bring about that alternative result. In the system of Fig. 2, each successive movement of the armature of relay A results in closing the previously open contact 15 or 16, with the result that an impulse of current flows from source 23 through resistance 24 and the winding of relay B via one of the condensers 19 or 20. This current impulse is effective to cause relay B to pull up its armature, thus closing the locking contact 14. Relay B remains energized pending subsequent closure of contact 25, which puts ground on both terminals of the winding of relay B, causing the latter to release. Relay B can, of course, be replaced by any desired electrical device capable, upon energization, of closing a locking circuit.

In each of the two previously described embodiments of the invention it has been predicated that contacts 15 and 16 are, respectively, the back and front contacts of a relay A—in which case there apparently would never be need for more than two parallel paths 17 and 18. Now I wish to point out that the invention is not limited to an arrangement comprising, specifically, two such paths, but may, in fact, be incorporated in a system comprising any number of such paths. It is rather obvious that the systems of Figs. 1 and 2 could be modified by eliminating either one of the two parallel paths 17, 18 and that such a modified system would, in appropriate circumstances, be useful; but it may not be so self-evident that three or more parallel paths could be employed. For that reason I have seen fit to show in Fig. 3 a modification of Fig. 2 comprising three parallel paths 26, 27 and 28, together with a rotary or other multiple contact switch 29. Any

movement of contactor 30 from one fixed contact to another will bring about energization of relay B, if the latter is not already energized.

Further description of Fig. 3 is not considered necessary in view of the fact that its operation is otherwise the same as that of the system of Fig. 2. Clearly, Fig. 1 can be modified in accordance with Fig. 3; and it goes without saying that switch 29 can have as many fixed contacts as desired and that there may be a corresponding number of parallel paths, each including a condenser shunted by a leakage resistance.

It will be understood, of course, that the invention is not limited to the embodiments shown and described but contemplates such further modifications as fall within the scope of the appended claims.

I claim:

1. In combination, an electrical device, a holding circuit for said device including a contact which is operative in response to energization of said device to close said holding circuit, and to open said holding circuit in response to deenergization of said device, a path including said device in series with a condenser and a switch, but excluding said contact, and means in shunt to said condenser for discharging the same, said path being closed upon closure of said switch.

2. In combination, an electrical device, a holding circuit for said device including a contact which is operative in response to energization of said device to close said holding circuit, and to open said holding circuit in response to deenergization of said device, a plurality of paths, each including an individual condenser, in series with said device but excluding said contact, switching means for selectively closing said paths individually, and means operative to discharge each of said condensers while the same is not included in a closed one of said paths.

3. In combination, an electrical device, a holding circuit for said device including said device in series with a contact and a source of current, said contact being operative in response to energization of said device to close said holding circuit, and to open said holding circuit in response to deenergization of said device, a circuit including said device for initially energizing said device, and means for de-energizing said device, said means comprising a path including said device in series with a condenser and a switch, and shunting means for discharging said condenser, said path being closed upon closure of said switch.

4. In combination, an electrical device, a holding circuit for said device including said device in series with a contact and a source of current, said contact being operative in response to energization of said device to close said holding circuit, and to open said holding circuit in response to deenergization of said device, a circuit for initially energizing said device and including said device in series with a condenser and also in series with a switch and a source of current, said condenser being shunted by a discharge path, and means for de-energizing said device to effect release of said contact and thereby open said holding circuit.

5. In combination, an electromagnet, a plurality of condensers, each shunted by a high resistance leakage path individual thereto, and switching means operative to complete a series path through a winding of said electromagnet and said condensers individually and selectively.

6. In combination, an electromagnet, a plu-

ality of condensers, each shunted by a high resistance leakage path individual thereto, switching means operative to connect said condensers individually and sequentially in series with a winding of said electromagnet, and a holding circuit for maintaining said electromagnet energized following each energization thereof. 5

7. In combination, a circuit comprising a winding of an electromagnet and a source of current, two parallel branch paths, and switching means operative to connect said branch paths alternately and individually into said circuit in series with said winding and source of current, each of said branch paths including a condenser individual thereto, each of said condensers being shunted by an individual leakage resistor, a holding circuit including said winding in series with a holding contact and a source of current, said holding contact being operative to close said holding circuit in response to energization of said winding and to open said holding circuit in response to de-energization of said winding, and means for short-circuiting said winding to effect de-energization thereof. 10 15 20

8. In combination, a circuit comprising a winding of an electromagnet and a source of current, two parallel branch paths, and switching means operative to connect said branch paths alternately and individually into said circuit in series with said winding and source of current, each of said branch paths including a condenser individual thereto, each of said condensers being shunted by an individual leakage resistor, a holding circuit including said winding in series with a hold- 25 30

ing contact and a source of current, said holding contact being operative to close said holding circuit in response to energization of said winding and to open said holding circuit in response to de-energization of said winding, and means for de-energizing said winding.

9. In combination, an electromagnet, a plurality of condensers, switching means operative to complete a series path through a winding of said electromagnet and each of said condensers individually and selectively, and means operative to discharge each of said condensers while the latter is not included in said series path.

10. In combination, an electrical device, a plurality of condensers, switching means operative to complete a series path through said device and each of said condensers individually and sequentially, means operative to discharge each of said condensers while the latter is not included in said series path, and a holding circuit for maintaining said device energized following each energization thereof.

11. In combination, an electrical device, a plurality of condensers, a source of current, switching means operative to complete a series circuit through said device and source and each of said condensers individually and sequentially, means operative to discharge each of said condensers while the latter is not included in said series circuit, a holding circuit for maintaining said device energized following each energization thereof, and means for thereafter releasing said holding circuit.

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