Jan. 2, 1934. F. W. SCHRAMM 1,941,627

REMOTE CONTROL SYSTEM

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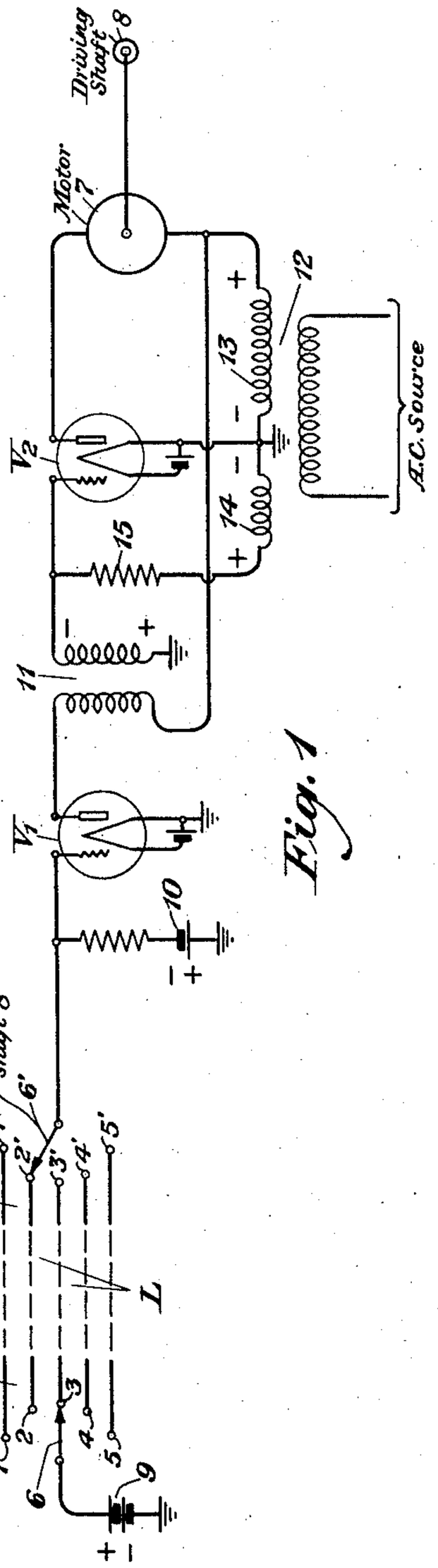

Fig. 1

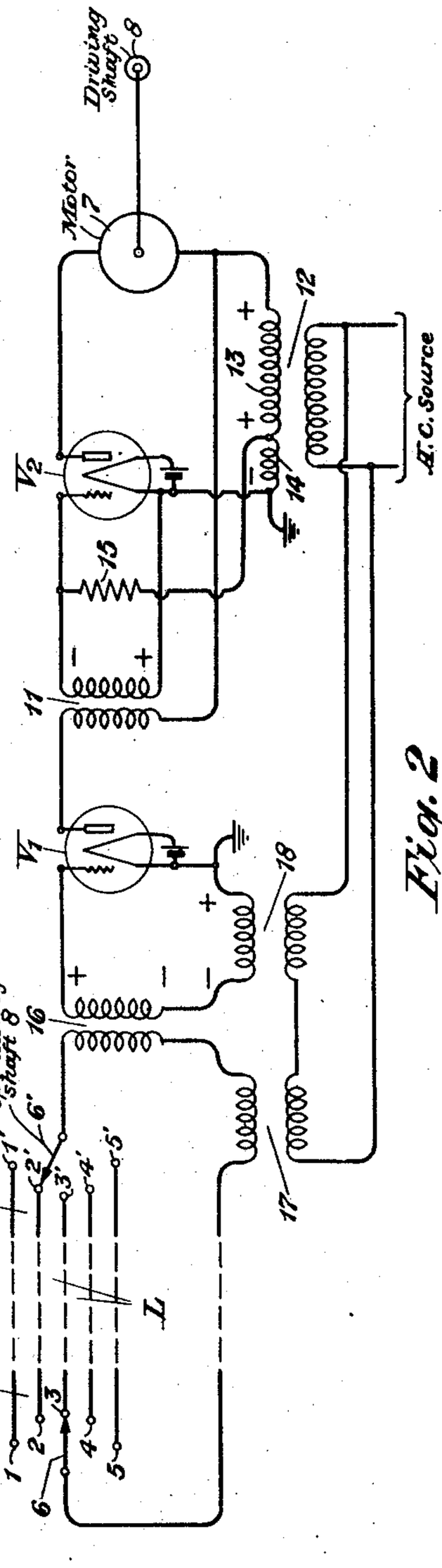

Fig. 2

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REMOTE CONTROL SYSTEM

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5 Claims. (Cl. 172—239)

This invention relates to improvements in systems wherein the operation of a device may be controlled by apparatus remote therefrom.

In the remote control system of the invention a circuit is provided between the controlling and controlled devices which includes a plurality of gas filled tubes of the type called grid-glow or thyratron tubes. These tubes may be filled with a gas such as neon. They have the characteristic that plate current will not flow until the grid potential reaches a certain value, after which the current flow is no longer dependent on the grid potential but only on the plate potential remaining positive and greater than the discharge voltage of the gas involved. The system of the invention might be utilized for the remote control of radio receivers, or similar devices, but its application may also be extended to other fields. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description, together with the accompanying drawing, in the Figures 1 and 2 of which the invention is illustrated. Fig. 1 is a circuit diagram embodying one form of the invention. Fig. 2 shows a modification thereof. Similar reference characters have been utilized to denote like parts in both of the figures.

In the arrangements of Fig. 1 is shown a switch S_1 whereby a motor 7 and a shaft 8 driven thereby and located at a distance from switch S_1 may be controlled by said switch. The shaft 8 might be utilized to operate various types of devices. For example, it might control a variable condenser in a radio set to control the tuning thereof. The switch S_1 would have a contact arm 6 connected to the battery 9. It would also have a plurality of contacts 1 to 5. The contacts would be connected over conductors L to a corresponding set of contacts 1′ to 5′ of a switch S_2. The switch S_2 would have a contact arm 6′ operated by the shaft 8. Whenever the contact arm 6′ is not on a contact corresponding to a setting of contact arm 6 of the control switch S_1, the battery 10 will maintain the grid of the gas filled tube V_1 at a negative potential sufficient to prevent current from flowing in the plate circuit of the tube V_1 and hence through transformer 11. Under such conditions the tube V_1 will have no effect on the gas filled tube V_2 as no voltage will be induced in the secondary of transformer 11 from tube V_1. Under these conditions the grid voltage of tube V_2 is supplied through resistance 15 from the alternating current source through winding 14 of transformer 12. The windings 14 and 13 of transformer 12 are so arranged that the voltages applied to grid and plate of tube V_2 are in phase. Accordingly, during the positive half-cycles the tube V_2 will break down and operate. This will operate the motor 7 and the shaft 8. The shaft 8 will move the contact arm 6′ of switch S_2 over the contacts 1′ to 5′.

When the shaft 8 moves the switch arm 6′ it will come in contact with a contact, such as 3′, corresponding to the setting of the control switch S_1. Under such conditions the positive voltage of battery 9 will be impressed on the grid of tube V_1. The positive voltage of battery 9 is sufficient to overcome the effect of the negative voltage of battery 10. The tube V_1 will accordingly break down and current will flow during the positive half-cycles of voltage impressed on the plate from the winding 13 of transformer 12 and the alternating current source. This will impress a high negative voltage on the grid of tube V_2 through the transformer 11, the secondary winding of transformer 11 being so connected that the voltage on the grid of tube V_2 will be 180° out of phase with the plate voltage of said tube and will be of sufficient magnitude to overcome the effect of the voltage applied from the grid winding 14 of transformer 12. This will quench tube V_2 and the motor will stop when the contact arm 6′ of the switch S_2 rests on a contact corresponding to the setting of control switch S_1. If the contact arm 6 of the control switch S_1 is again moved, the above sequence of operations will be repeated until the contact arm 6′ of switch S_2 again rests on a contact corresponding to the setting of the control switch. Resistance 15 is provided to prevent short-circuiting the secondary of transformer 11 and winding 14 of transformer 12.

In Fig. 2 is shown an arrangement substantially similar to that of Fig. 1 except that it is arranged for operation entirely on alternating current. Similar reference characters have been utilized to denote like parts in both figures. A source of alternating current is provided which through transformer 12 will supply voltages for the grid and plate of tube V_2. The windings 13 and 14 of transformer 12 are so arranged that the grid and plate voltages supplied therefrom will be in phase and the tube, if not otherwise affected, will operate thereon. The battery 10 of Fig. 1 is replaced by the transformer 18 connected to the source of alternating current. The secondary winding of transformer 18 is so arranged with respect to the secondary winding 13 of trans-

former 12 that the voltage applied to the grid of tube V_1 will be 180° out of phase with that applied to the plate of said tube and normally it will not operate unless affected by other voltages. Accordingly, when the switch arm 6' of switch S_2 is not on a contact corresponding to the setting of the control switch S_1, the tube V_1 will not operate and the tube V_2 will operate. This will operate the motor 7 and shaft 8 and the switch arm 6' will be moved until it rests on a contact corresponding to the setting of control switch S_1. When this takes place, a circuit will be closed for the primary winding of transformer 16. A current will be transmitted from the alternating current source and through transformer 17 to this circuit. This will cause to be applied to the grid of tube V_1 through transformer 16 a voltage in phase with that applied to the plate of tube V_1. This voltage will be large enough to overcome the effect of the voltage applied to the grid through transformer 18, which as has been pointed out, was 180° out of phase with the plate voltage and blocked the tube operation. Accordingly, tube V_1 will now operate. In a like manner to that heretofore described, the output of tube V_1 will apply to the grid of tube V_2 a voltage which will block the operation of tube V_2 and stop the operation of motor 7 and shaft 8.

As has been heretofore pointed out, the remote control arrangements of the invention are applicable for use with other types of devices than radio receivers. For example, instead of using the motor and shaft to control a variable condenser in a radio receiver, the motor and shaft might be replaced by a stepping device with contacts to be stopped at any desired point, such as selectors, automatic elevators, and so forth. Accordingly, while the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A control system comprising two gas filled discharge tubes connected in tandem, a device to be controlled associated with the output circuit of the second tube, switching means connected to the input of the first tube for rendering said tube operative or inoperative, means for so interconnecting said tubes that the operation of said first tube will render the second tube inoperative and the deenergization of the first tube will render the second tube operative, and means operated by said controlled device for controlling said switching means.

2. A control system comprising two gas filled discharge tubes connected in tandem, a device to be controlled associated with the output circuit of the second tube, switching mechanism associated with the grid of the first tube, said switching mechanism comprising two switches each having contact arms and corresponding sets of contacts, means operative when said switches are not on corresponding settings for applying a blocking voltage to the grid of said first tube, means operative when said switches are on corresponding settings for removing the blocking voltage from the grid of said first tube and causing it to operate, means controlled by the operation or deenergization of said first tube for causing the deenergization or operation respectively of said second tube, and means operated by said controlled device for operating the contact arm of one of said switches to restore said switches to corresponding settings.

3. A control system comprising two gas filled discharge tubes connected in tandem, a device to be controlled associated with the output circuit of the second tube, switching means connected to the input of said first tube for rendering said tube operative or inoperative, a source of alternating current, a transformer connected to said source and having secondary windings so arranged that operating voltages in phase with each other will be applied from said source to the grid and plate of said second tube and to the plate of said first tube, a transformer having a primary winding in the plate circuit of said first tube and a secondary winding connected to the grid of said second tube, said last mentioned secondary winding being so arranged that the voltage applied from said first tube to the grid of said second tube will be 180° out of phase with the voltage applied to the plate thereof from said source, and means operated by said controlled device for controlling said switching means.

4. A control system comprising two gas filled discharge tubes connected in tandem, a device to be controlled associated with the output circuit of the second tube, a source of alternating current, a first transformer connected to said source and having secondary windings so arranged that operating voltages in phase with each other will be applied from said source to the grid and plate of the second tube and to the plate of the first tube, a second transformer having a primary winding in the plate circuit of said first tube and a secondary winding connected to the grid of said second tube, said last mentioned secondary winding being so arranged that the voltages applied from said first tube to the grid of said second tube will be 180° out of phase with the voltage applied to the plate thereof from said source, a third transformer connected to said source and having a secondary winding connected to the grid of said first tube, said secondary winding being so arranged that the voltage applied to the grid of said first tube will be 180° out of phase with the voltage applied from said source to the plate of said tube, and switching means operated by said controlled device for applying to the grid of said first tube a voltage in phase with the voltage applied to the plate of said tube and of sufficient magnitude to overcome the effect of the aforementioned voltage applied from said source to the grid of said tube.

5. A control system comprising two gas filled discharge tubes connected in tandem, a device to be controlled associated with the output circuit of the second tube, a source of alternating current, a first transformer connected to said source and having secondary windings so arranged that operating voltages in phase with each other will be applied from said source to the grid and plate of the second tube and to the plate of the first tube, a second transformer having a primary winding in the plate circuit of said first tube and a secondary winding connected to the grid of said second tube, said last mentioned secondary winding being so arranged that the voltages applied from said first tube to the grid of said second tube will be 180° out of phase with the voltage applied thereto from said source, a third transformer connected to said source and having a first and second secondary winding, said first secondary winding being connected to the grid of said first tube and being so arranged that the voltage applied thereby to the grid of

said first tube will be 180° out of phase with the voltage applied from said source to the plate of said tube, a circuit including switching means operated by said controlled device, said second secondary winding being included in said circuit and adapted to apply thereto voltages from said source in phase with the voltages applied therefrom to the plate of said first tube, and means controlled by said switching means for applying the voltages from said circuit to the grid of said first tube.

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