

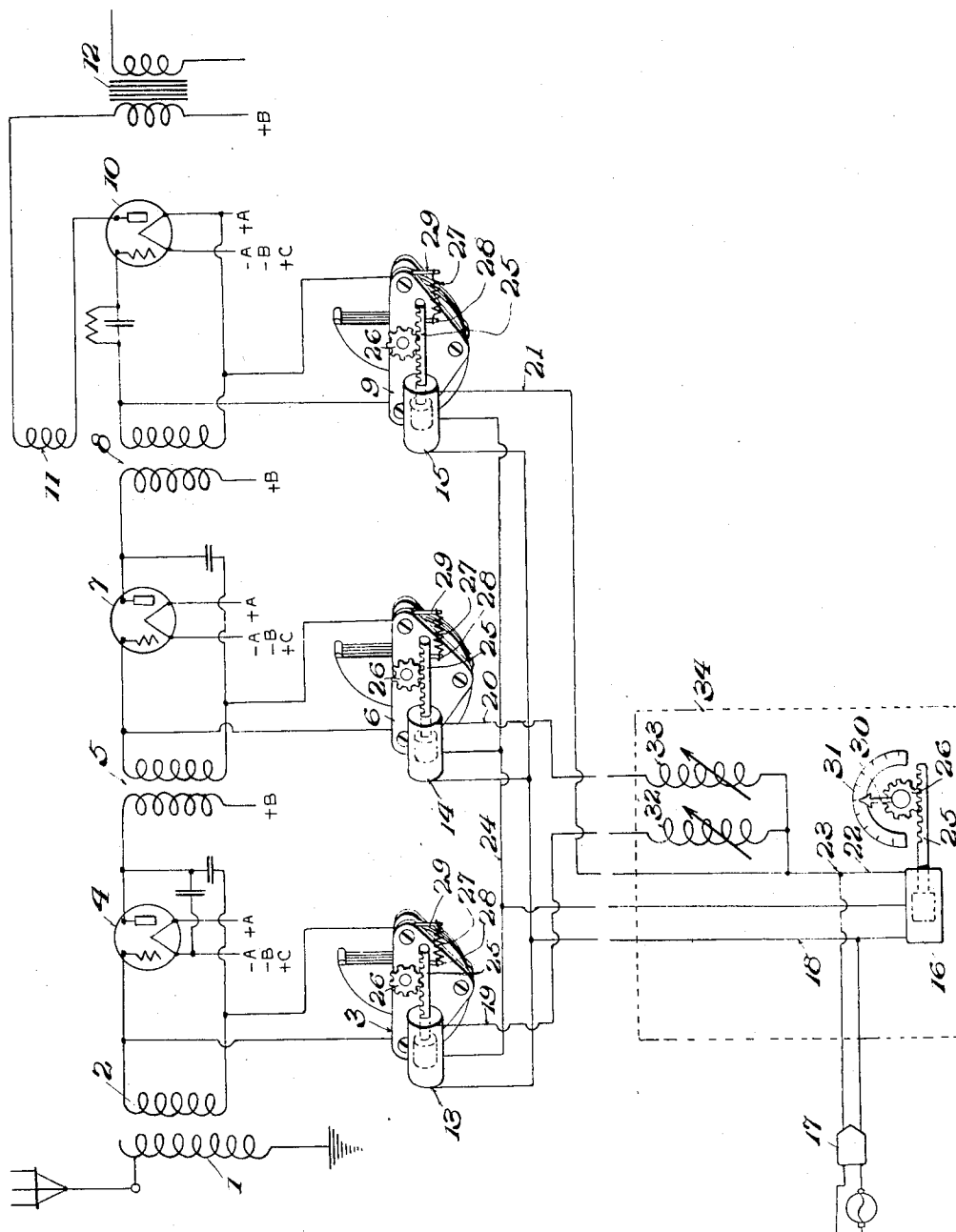
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CONTROL APPARATUS

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CONTROL APPARATUS

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This invention relates to remote control apparatus, and particularly to a remote control apparatus which is available for use in conjunction with radio apparatus, although not limited to such use.

Various means have heretofore been proposed whereby an element to be controlled may be caused to follow the movements of a control element at a distance therefrom, but such devices have been open to various objections. Numerous types of mechanical connections—for example, flexible shafts, cords and pulleys, etc.—have been employed for this purpose, but such devices lack flexibility of control and mobility of the remote control element, and involve many mechanical difficulties which generally preclude their successful use. Various types of electrical control systems have likewise been devised, but such systems have involved expensive and troublesome complications in wiring and equipment. In general, expensive and cumbersome equipment has been required, such as electric motors or similar prime mover units, combined, for example, with suitable clutch means or reversible controls, etc. Where a plurality of distant elements are to be controlled, these systems involve electrical complications and consequent maintenance difficulties which render them commercially impracticable.

One of the objects of the present invention is to obviate the above disadvantages and to provide a simple and efficient system which is reliable in operation and of inexpensive construction.

Another object is to provide novel means for causing a distant element to follow the movements of a remote control element.

Another object is to provide novel means wherein the movement of a single remote control element simultaneously controls a plurality of distant elements.

A further object is to provide a remote control system having remote unit control means and remote individual control means.

A still further object is to provide a remote control system capable of independent as well as conjoint control of the controlled elements.

Another object is to provide a remote control for radio receivers suitable for use in present day radio sets without undue complexity arising from the need of controlling a multiplicity of elements.

Another object is to provide a remote control apparatus operable by alternating current such as ordinary house lighting current.

Other objects will appear as the description of the invention proceeds.

With the above objects in view, a plurality of solenoid coils, each having associated therewith a movable armature, are connected in parallel across any suitable source of alternating current, for example, ordinary house lighting current, and the center points of the coils are connected by any suitable circuit means. If any one of said armatures be moved relatively to its coil, a change in the flow of current through each of the other coils in the system will be produced, which will cause a movement of each remaining armature relative to its coil. If the coils and armatures and other conditions are substantially the same, the movements of all of the armatures will be substantially equal and corresponding, and for any given conditions, a definite relation will always exist between the positions of each armature relative to the others. Therefore, if one or more of said armatures are connected with control members and the other armatures with members to be controlled by any suitable means, any movement of one of said control members will cause a relative movement of all of the remaining members in the system and all of said members will occupy definite relative positions at all times which can be predetermined.

Furthermore, in case it is desired to control any one of said members individually, any suitable means may be connected in any one, or all, of said parallel circuits for individually varying the electrical constants thereof. Variable inductances, for example, inserted in the individual circuits, can be made to produce a supplemental change of the current flowing through said circuits and thereby cause a supplemental or vernier adjustment of the individual armatures.

Such a system is obviously suitable for a wide variety of purposes including any kind of distant indication or control—for example, telemetric control apparatus, distant gauge indication, control means for ordnance apparatus, and many others. The invention is particularly well adapted for the distant control of radio apparatus, and the accompanying drawing shows, more or less schematically, for purposes of exemplification, the invention as applied to a typical radio receiving circuit. It will be expressly understood, however, that the invention is not limited to this embodiment or application thereof, reference being had to the appended claims for a definition of the limits of the invention.

Referring now to the drawing, there is shown diagrammatically a typical radio receiving circuit comprising two stages of radio amplification and a detector. The receiver is provided with

the usual antenna to ground circuit 1, having coupled thereto an oscillating circuit comprising an inductance 2 and variable condenser 3, said oscillating circuit being connected across the grid and filament of a vacuum tube 4. The plate circuit of the tube 4 is coupled by the transformer 5 with an oscillating circuit comprising the secondary of said transformer and a variable condenser 6. Said oscillating circuit is connected to the grid and filament of tube 7, the plate circuit of which is coupled by a transformer 8 with an oscillating circuit comprising the secondary of said transformer and a variable condenser 9. Said oscillating circuit is connected to the grid and filament of a detector tube 10, which is shown as having a feedback coil 11, and output transformer 12. It will be understood that the particular circuit above described is shown merely for the purpose of illustration and constitutes no part of the present invention.

For the purpose of controlling the three variable tuning elements, namely, the variable condensers 3, 6 and 9 from a remote point, said elements are connected by a remote control system, such as hereinbefore described, with a suitable remote control and indicating means. In the form shown, said system comprises the solenoids 13, 14 and 15, which are connected by any suitable means with the said variable condensers, and the solenoid 16 which is similarly connected with the remote control element. Said solenoids are preferably connected in parallel across any suitable source of alternating current, which may be supplied, for example, by a connector plug 17, adapted to be connected to a house lighting circuit. One end of each solenoid coil is connected to one side 18 of the circuit and the other ends of said coils are connected by individual wires 19, 20, 21 and 22 with a common point 23 in the other side of the circuit. The center points of each coil are connected together by any suitable means such as the circuit 24.

In the form shown, wherein each of the condensers and the control element is of a rotary type, the solenoid armatures are connected to said rotary elements by means of rack bars 25, gearing with pinions 26 mounted on the respective shafts of said rotary elements. The solenoids 13, 14 and 15 are preferably provided with any suitable means for normally maintaining the armatures thereof in their initial positions, such as the springs 27 interposed between pins 28 on the rack bars 25 and pins 29 on the condenser supports. Any suitable means may be employed for the purpose of maintaining the control element in any desired position, such as suitable frictional or locking means.

The operation of the system is as follows:—When the control element, which may comprise a suitable pointer 30 and dial 31, is rotated, the rack bar 25 is moved by the pinion 26 and the armature of the solenoid 16 is moved relative to its coil, thereby causing a change in the amount of current flowing through each solenoid in the system. The variation in the current through solenoids 13, 14 and 15 causes a movement of each of the respective armatures and rack bars 25, whereby the movable plates of the variable condensers 3, 6 and 9 are similarly rotated. As hereinbefore pointed out, if the solenoids and armatures are all substantially the same, the said armatures will occupy at all times corresponding positions and the movements of the three variable condensers will follow the movements of pointer 30 in predetermined relation.

For the purpose of providing for moving certain or all of the variable tuning elements individually, any suitable independently variable means may be included in certain or all of the parallel solenoid circuits for changing the electrical characteristics thereof. In the form shown, the condensers 3 and 6 are made independently variable by means of any suitable variable inductances 32 and 33, preferably connected respectively in the wires 19 and 20. Said variable inductances are preferably combined with the control element 30 and its solenoid 16 at the remote control station, and said elements may be, if desired, combined and mounted in a suitable control box indicated diagrammatically at 34.

The system above described provides a remote control apparatus which is very simple and inexpensive and yet reliable and efficient in operation. The system is capable of expansion to any desired number of elements, merely by the connection of additional solenoids in parallel across the circuit. The individual elements of the system are few and are of standard character, and therefore readily attainable and of comparatively small cost. The apparatus at the remote control station and the apparatus connected with the elements to be controlled are entirely separate except for the provision of connecting wires, which are few in number and may be readily combined in a single flexible cable. It will likewise be observed that this system provides a remote unit control apparatus, whereby a plurality of elements may be simultaneously controlled from a single remote element, combined with a remote individual control apparatus whereby the said distant elements may be controlled individually from the remote control station, said remote individual control being independent of the unit control or supplemental thereto. The latter feature is of particular importance in connection with radio apparatus, since owing to slight differences in the electrical values of the tuning capacities it is usually necessary to provide for small vernier adjustments of the tuning elements. The invention is not restricted to the uses hereinbefore pointed out, but as suggested is capable of application to any kind of remote control. For example, in connection with electrical apparatus, other electrical elements, as inductances, resistances, etc., may be controlled thereby—such as volume controls, filament controls, and many others.

While only one embodiment of the invention has been illustrated in the drawing, it will be readily understood that the invention is capable of a wide variety of applications and that changes in the construction, arrangement and assembly of the parts, which will be readily apparent to those skilled in the art, may be made without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:—

1. In apparatus of the class described, the combination of a plurality of solenoids connected in parallel circuits across a source of alternating current, a circuit connecting the center points of said solenoids, movable core members for each of said solenoids, and means independent of said solenoids for varying the electrical constants of certain of said parallel circuits.

2. In apparatus of the class described, the combination of a source of alternating current, a plurality of solenoids connected in parallel circuits across said source, a circuit connecting the cen-

ter points of said solenoids, movable core members for said solenoids, whereby movement of one of said members causes related movements of the remaining members, and variable inductance means in certain of said parallel circuits to control said members individually.

3. In apparatus of the class described, the combination of a plurality of parallel circuits supplied from a source of alternating current, each circuit including a coil having a movable magnetic core, a circuit connecting the center points of said coils, means for moving one of said cores to cause related movements of the remaining cores, and independently variable current controlling means in certain of said circuits.

4. In apparatus of the class described, the combination of a plurality of solenoid coils connected in parallel circuits across a source of alternating current, each of said coils having similar electrical characteristics, a circuit connecting the center points of said coils, movable core members for said coils, whereby movement of one of said core members causes substantially equal and corresponding movements of the remaining core members, and supplemental means for independently varying the electrical characteristics of certain of said circuits and thereby individually adjusting the respective core members.

5. In apparatus of the class described, the combination of a plurality of solenoid coils connected in parallel circuits across a source of alternating current, each of said coils having similar electrical characteristics, a circuit connecting the center points of said coils, movable core members for said coils, whereby movement of one of said core members causes substantially equal and corresponding movements of the remaining core members, and variable inductance elements in certain of said circuits for individually adjusting the respective core members.

6. In apparatus of the class described, the combination of a control element, a plurality of members to be controlled thereby, a plurality of solenoid coils having similar electrical characteristics and connected in parallel circuits across a source of alternating current, a circuit connecting the center points of said coils, a movable core for each coil, means operatively connecting said control element and said members each with one of said cores, and means for independently varying the electrical characteristics of certain of said parallel circuits.

7. In apparatus of the class described, the combination of a control element, a plurality of members to be controlled thereby, a plurality of solenoid coils having similar electrical characteristics and connected in parallel circuits across a source of alternating current, a circuit connecting the center points of said coils, a movable core for each coil, means operatively connecting said control element and said members each with one of said cores, and variable inductance means in certain of said parallel circuits.

8. In radio apparatus, the combination of a plurality of tuning elements, a control member therefor, a plurality of solenoids connected in parallel across a source of alternating current, a circuit connecting the center points of said solenoids, a movable core for each solenoid, and means operatively connecting each of said tuning elements and said control member to one of said movable cores, and independently variable current controlling means in certain of said parallel circuits.

9. In radio apparatus, the combination of a plurality of tuning elements, a control member, a plurality of solenoids connected in parallel circuits across a source of alternating current, a circuit connecting the center points of said solenoids, a movable core for each solenoid, a rack operatively connected to each core, a gear for each tuning element and for said control member, said gears engaging said racks, and variable inductance elements in certain of said circuits.

10. In radio apparatus, the combination of a plurality of tuning capacities, a control member therefor, a plurality of solenoids connected in parallel circuits across a source of alternating current, a circuit connecting the center points of said solenoids, a movable core for each solenoid, resilient means tending to maintain said cores in normal position, a rack operatively connected to each core, a pinion for each capacity and for said control member, said pinions engaging said racks, and independently variable inductance elements in certain of said circuits.

11. Remote control radio apparatus comprising in combination a plurality of movable tuning elements, a single remote indicating and controlling member, electrical transmission means associated with said member and with said tuning elements to cause each of said tuning elements to follow the movements of said indicating member, said transmission means including a main alternating current circuit controlled by said member and branch circuits connected therewith for supplying controlling current for said elements, and supplemental remote control means in said branch circuits for individually adjusting said tuning elements independently of said member.

12. Remote control radio apparatus comprising in combination a plurality of movable tuning elements, remote control means, including a single movable, electrical control element having an indicator, a balanced electrical transmission means connecting said elements and indicator whereby movement of said indicator causes substantially equal movements of each tuning element, said remote control means including separate independently adjustable circuit impedance elements arranged to move certain of said tuning elements individually.

13. In radio apparatus, the combination of a plurality of tuning elements, an individual electrical actuator for each of said elements, an alternating current electrical control circuit therefor including variable impedance, means for operating certain of said actuators individually from a remote point, separate and independently variable electrical impedance means in said circuit at said remote control point for operating all of said elements conjointly, and a single indicating control member for said last named means.

14. In a radio remote control system, the combination with a plurality of individual movable control elements adjustable each through substantially the same predetermined control range of operation, of a remotely located movable indicating control member therefor, a balanced solenoid alternating current control system arranged to interconnect said movable control elements and said last named control member, said system including individual control circuits interposed between said control member and certain of said control elements, and individually adjustable circuit impedance means located in certain of said individual circuits adjacent to said remote control member.

15. In apparatus of the class described, the combination of a plurality of solenoids connected in parallel circuits across a source of alternating current, a circuit lead connecting the center points of said solenoids, movable core members for each of said solenoids, and means independent of said solenoids for varying the circuit impedance of certain of said parallel circuits.
16. In a radio remote control system, the combination of a plurality of solenoids connected in parallel circuits across a source of alternating current, a movable core member for each of said solenoids, and means independent of said solenoids, for varying the circuit impedance of certain of said parallel circuits.
17. In a radio remote control system, the combination of a plurality of solenoids connected in parallel circuits across a source of alternating current, a movable core member for each of said solenoids, a common circuit lead connected with a tap point between the terminal ends of each solenoid, and means independent of said solenoids, for varying the circuit impedance of certain of said parallel circuits.
18. In a radio remote control system, the combination of a plurality of solenoids connected in parallel circuits across a source of alternating current, a movable core member for each of said solenoids, a common circuit lead connected with a tap point between the terminal ends of each solenoid, whereby movement of one core causes a variation in the current flow in said parallel circuits, and means independent of said core, for varying the current flow in certain of said parallel circuits.
19. Remote control radio apparatus comprising in combination, a plurality of movable tuning elements, a movable remote control member, electrical transmission means associated with said member and with said tuning elements and being electrically interconnected to cause each of said tuning elements to follow the movements of said control member, said transmission means including a main alternating current circuit controlled by said member and branch circuits connected therewith for supplying controlling current for said elements, and supplemental remote control means in said branch circuits for individually adjusting said tuning elements independently of said member.
20. In radio apparatus, the combination of a plurality of tuning elements, an individual electrical actuator for each of said elements, an alternating current electrical control circuit therefor including variable impedance means for operating certain of said actuators individually from a remote point, and separate and independently variable electrical impedance means in said circuit at said remote control point for operating all of said elements conjointly.
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