Dec. 1, 1931. G. R. EATON ET AL 1,833,893

TUNING CONTROL

Filed June 14, 1929 3 Sheets-Sheet 1

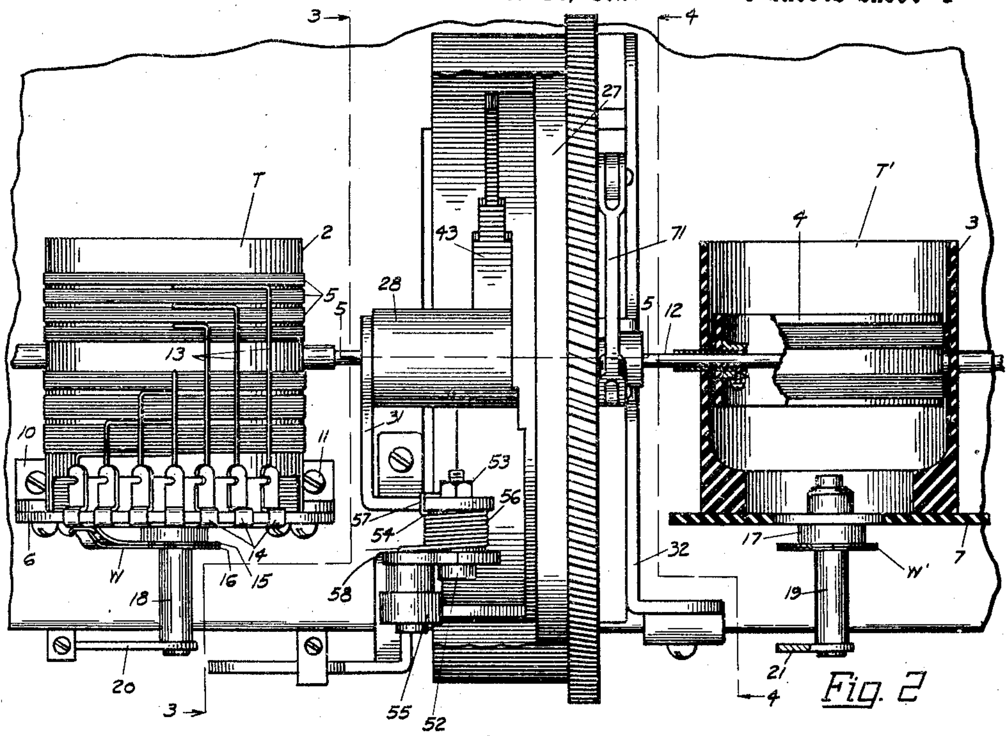
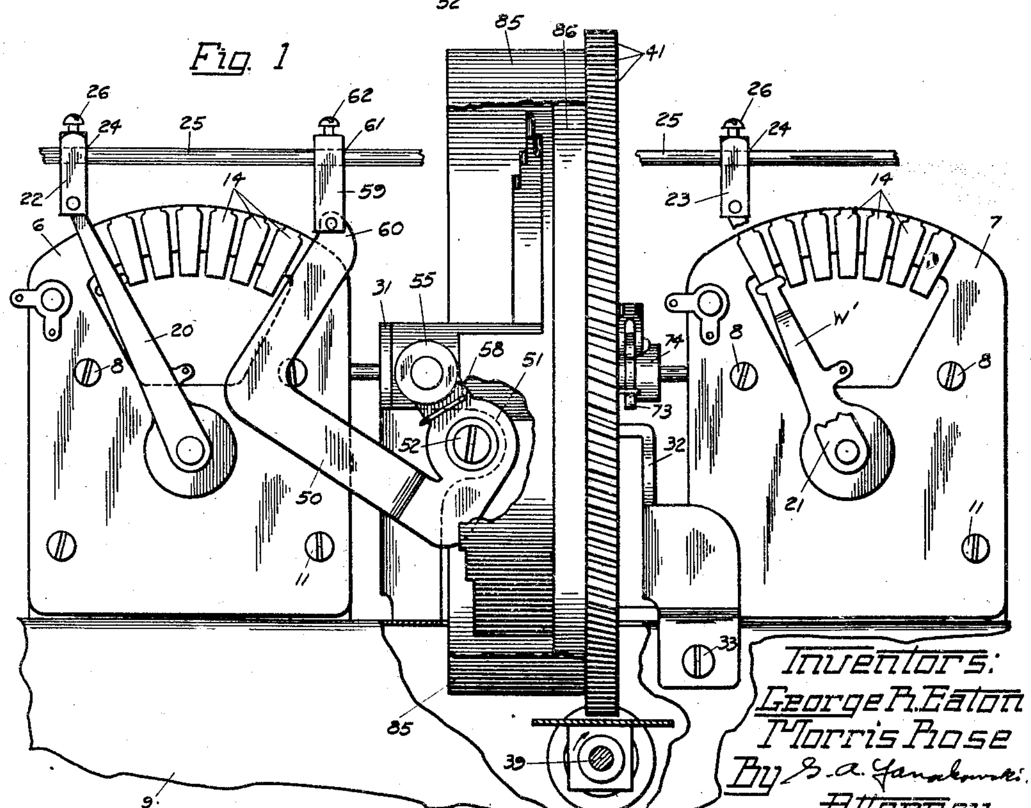


Fig. 2

Fig. 1



Inventors:
George R. Eaton
Morris Rose
By G. A. Janakowski
Attorney.

Dec. 1, 1931.

G. R. EATON ET AL

1,833,893

TUNING CONTROL

Filed June 14, 1929

3 Sheets-Sheet 2

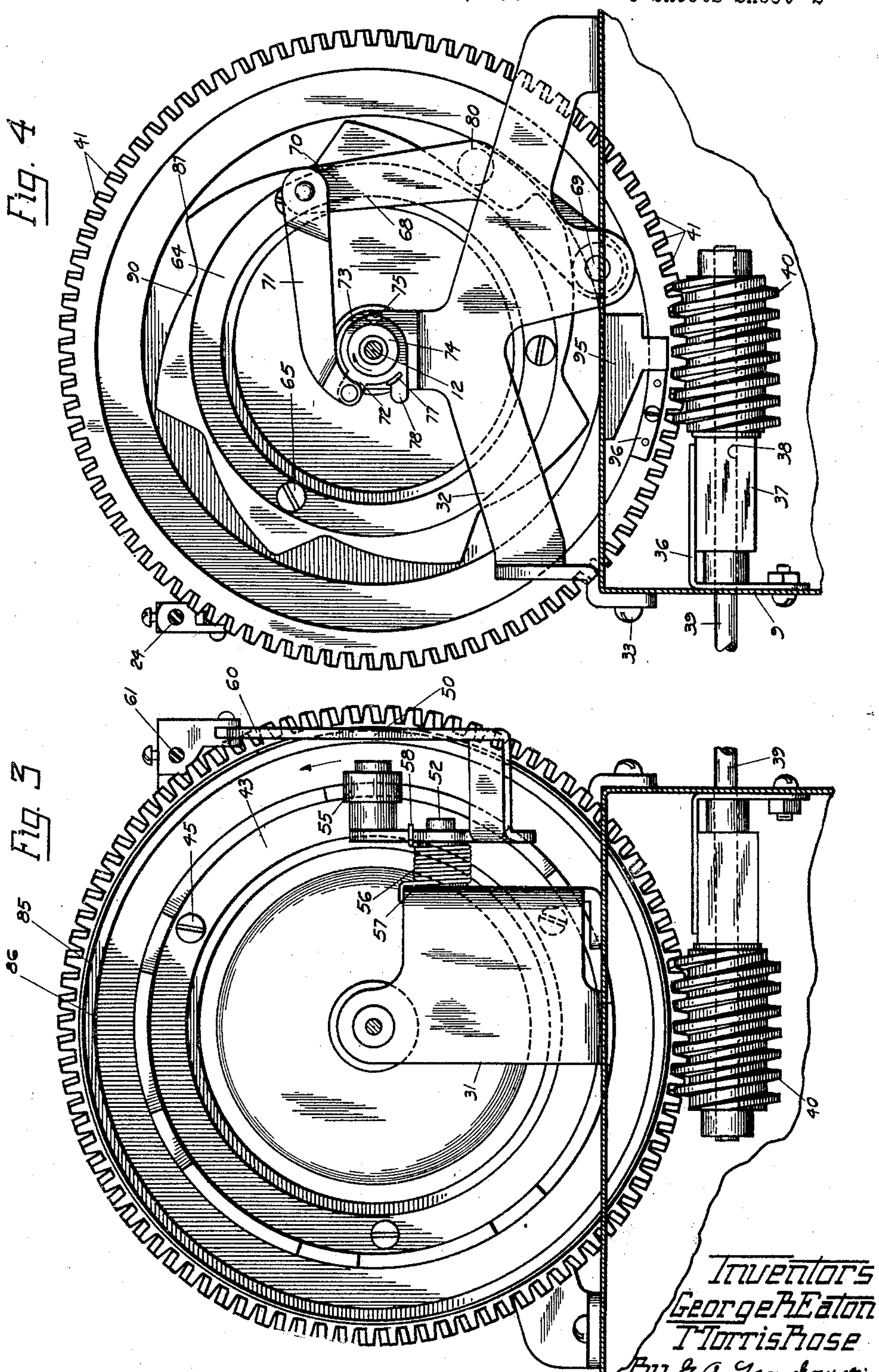


Fig. 4

Fig. 3

Inventors
George R. Eaton
T. Morris Rose
By G. A. Janckowski
Attorney.

Dec. 1, 1931. G. R. EATON ET AL 1,833,893

TUNING CONTROL

Filed June 14, 1929 3 Sheets-Sheet 3

Fig. 7

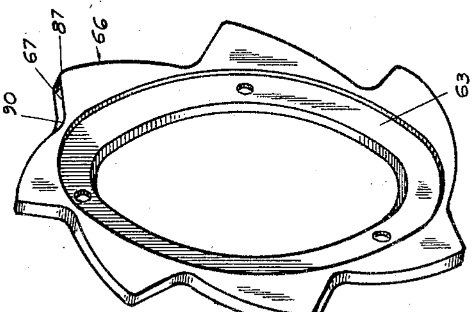


Fig. 8

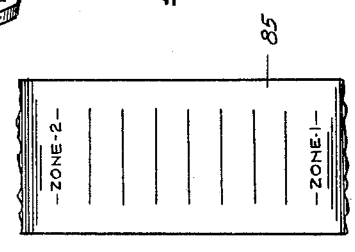


Fig. 6

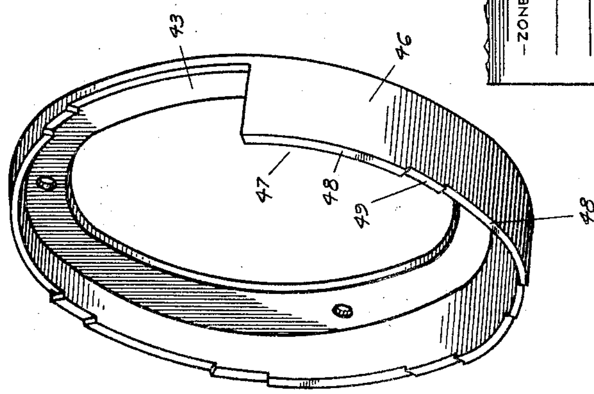
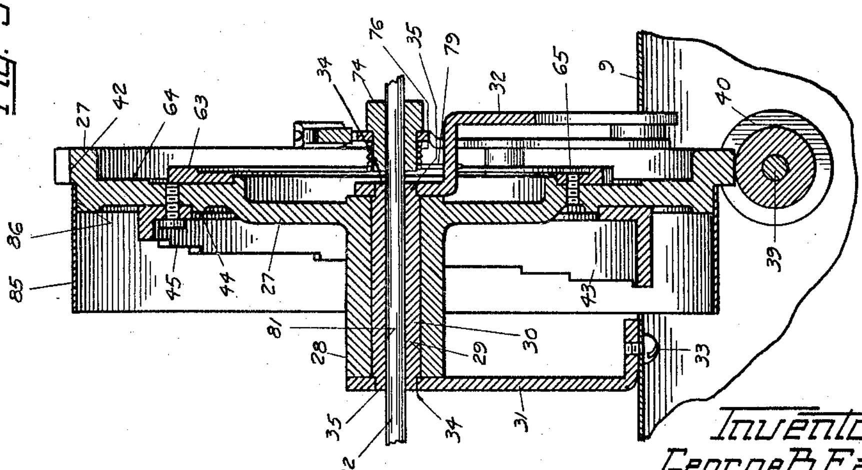


Fig. 5



Inventors:
George R. Eaton
Morris Rose
By G. A. Yanochowski
Attorney.

Patented Dec. 1, 1931 1,833,893

UNITED STATES PATENT OFFICE

GEORGE R. EATON, OF OAK PARK, AND MORRIS ROSE, OF CHICAGO, ILLINOIS, ASSIGNORS TO KELLOGG SWITCHBOARD & SUPPLY CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

TUNING CONTROL

Application filed June 14, 1929. Serial No. 370,811.

Our invention relates to the tuning of a multiple arrangement of couplers or transformers such as are used in an inductively tuned radio receiving circuit, and has to do more particularly with the tuning of couplers or transformers in which the inductance of the secondaries of the couplers or transformers of such a multiple arrangement is simultaneously varied in steps by means of a switch arrangement and in which the inductance within the steps is simultaneously varied.

An object of our invention resides in a novel tuning control for an arrangement of the above type and the method of construction and arrangement of parts for the same.

A feature of our invention is the provision of a single control member for varying the inductance of the secondaries of a plurality of transformers simultaneously in steps and for simultaneously varying the inductance of the transformers within the steps.

Another feature of our invention is the provision of an operating member, in combination with a single control member for actuating the same, and cam members secured to the said operating member which, in association with a pair of arms, control the movements of the switch arrangement for varying the inductances of the transformers in steps and for varying the inductances within the steps.

Another feature of the invention resides in the provision of a pair of cams on the operating member which cooperate with a pair of arms whereby one of said cams and its arm effect the simultaneous movement of switches associated, respectively, with the tapped inductances of a plurality of transformers to positions corresponding to predetermined taps or zones and, while said switches remain in their predetermined positions, the other cam and its arm effect the movement of the rotor elements of the transformers to vary the inductances within the predetermined zone.

The above features as well as others not particularly pointed out above will be more fully described in the ensuing specification and pointed out in the appended claims.

For a more complete understanding of our invention reference may be had to the accompanying drawings in which like reference characters in the several views denote like parts, and in which

Fig. 1 is a front elevation of the tuning control of our invention operatively associated with a multiple control arrangement and in which the front panel has been removed to more clearly illustrate the mechanism associated therewith;

Fig. 2 is a top view of Fig. 1;

Fig. 3 is a sectional view along the line 3—3 of Fig. 2 looking in the direction of the arrow and illustrates clearly the cam member and its associated parts for controlling the movement of the switch mechanism by successive steps to the various zones into which the secondaries of the transformers are divided;

Fig. 4 is a sectional view along the line 4—4 of Fig. 2 looking in the direction of the arrow and clearly illustrates the cam member and its associated parts for controlling the movements of the rotor elements of the transformers to vary the inductances within the steps or zones;

Fig. 5 is a sectional view along the line 5—5 of Fig. 2;

Fig. 6 is a perspective view of the cam which controls the movement of the switch mechanism associated with the transformers;

Fig. 7 is a perspective view of the cam which controls the movement of the rotor elements of the transformers, and

Fig. 8 shows a fragment of the indicator dial clearly illustrating the zone divisions corresponding to the switch positions and the calibrations of the dial within the zones.

Referring now more in detail to our invention, as illustrated in the accompanying drawings, the tuning control of our invention, for the purpose of illustration and description, is shown associated with a multiple control arrangement for controlling the operation of an inductively tuned radio receiving circuit which comprises a plurality of transformers, portions of two of which are shown in the drawings. The transformers T and T' comprise the stator tubes 2 and 3 and the rotatable rotor tubes or elements 4 mounted within the stator coils 2 and 3. One of the rotor tubes is shown clearly in Fig. 2. The stator tubes 2 and 3 support suitable windings 5 and are secured to panels 6 and 7 by means of screws 8, and these panels 6 and 7 are in turn fixed to a suitable sub-base 9 by means of brackets 10 which are secured respectively to the panels 6 and 7 and sub-base 9 by means of the screws 11.

The rotor elements 4 are supported on a suitable rod 12 which may be rotated to simultaneously rotate the rotor elements 4, 90 degrees or until their axes are at right angles to the axes of the stator coils 2 and 3. The windings 5, supported on the stator tubes 2 and 3, are tapped and these taps 13 are connected to contacts 14 mounted on the panels 6 and 7. The contacts 14, which are suitably secured to the respective panels 6 and 7 in arcs of circles, are adapted to be engaged by the double wiper arms W and W'. The wiper arms W and W' each comprises wipers 15 and 16, the free ends of which wipe over the opposite sides of the contacting ends of their respective groups of contacts 14.

The wipers 15 and 16 of the respective wiper arms W and W' are supported by suitable wiper supporting members 17 which are rotatably supported on the respective panels 6 and 7. Studs 18 and 19, secured to the wiper supporting members 17, extend forward from the panels 6 and 7 and have secured to their respective ends arms 20 and 21. The free ends of the arms 20 and 21 pivotally support link members 22 and 23 provided with orifices 24 through which extends a connecting member or rod 25 held in position by means of the set screws 26. The rod 25 connects the arms 20 and 21 associated respectively with the wipers W and W' and, through the medium of the tuning control of my invention, the wipers W and W' are moved simultaneously step by step to engage successive contacts 14 of their respective groups.

Having described in general the multiple control arrangement with which we associate the tuning control of our invention, we will now describe in detail the tuning control mechanism and its operation in association with the multiple control arrangement illustrated. The tuning control comprises a rotatable disk 27 having an integrally formed projecting hub 28 with a central orifice 29 therethrough in which a sleeve 30 is secured by a drive fit. A pair of brackets 31 and 32, secured to the sub-base 9 by means of the screws 33, are positioned on opposite sides of the disk 27 and are provided with aligned orifies 34 which receive the reduced end portions 35 of the sleeve member 30 to rotatably support the disk 27. An angular bracket 36, secured to the sub-base 9, has secured to it a bearing block 37 provided with an orifice 38 through which a stub shaft 39 extends. A worm 40 is secured to the shaft 39 and meshes with the teeth 41 of a spiral gear cut in the circumferential face 42 of the disk 27. The shaft 39, which protrudes through an orifice in the front plate of the sub-base 9, supports a suitable operating knob (not shown), through the agency of which the shaft 39 and worm 40 secured thereto are rotated. As the worm 40 meshes with the spiral gear teeth 41 of the disk 27, the said disk 27 will be rotated also for purposes which will presently be described.

A ring shaped member 43, secured to the face 44 of the disk 27 by means of the screws 45, is provided with an integrally formed annular wall 46, the circumferential edge or rim 47 of which is provided with a plurality of alternately long and short faces 48 and 49, arranged in steps, which cooperate with an arm 50. The arm 50 is L shaped and is pivotally secured to the ear 51 integral with the bracket 31 by means of a pivot screw 52 and nut 53. A sleeve 54 on the pivot screw 52 spaces the arm 50 from the bracket 31. A roller 55 supported on the arm 50 is pressed into engagement with the faces 48 and 49 by a spring 56 coiled about the sleeve 54 with its one end 57 formed to engage the bracket 31 and its other end 58 formed to engage the arm 50. The tension of the spring 56 is such as to force the roller 55 to the right, as seen in Fig. 1, to maintain the roller in engagement with the faces 48 and 49 as the disk 27 is rotated. A link 59 pivotally secured to the free end 60 of the arm 50, is provided with an orifice 61 through which extends the rod 25. A set screw 62 locks the rod 25 in link 59. As the rod 25 is pivotally connected to arms 20 and 21, associated with wipers W and W', as well as to arm 50, the said arms will all move together. The connection of the arm 50 to the rod 25 is for the purpose of controlling the step by step movement of the wipers W and W' over their respective groups of contacts 14 as will be more fully hereinafter described.

An annular disk 63 is secured to the face 64 of the disk 27 by the screws 65. The peripheral edge of disk 63 is in the form of ascending and descending cam faces 66 and 67 which cooperate with an arm 68 pivotally secured to the bracket 32 by a pivot member 69. The free end 70 of the arm 68 has pivotally secured thereto one end of an arm 71, the other end of which is pivotally secured to an ear 72 formed integrally with a plate member

73 fixed to a collar 74 secured on the rod 12 by means of a set screw 75. A coil spring 76, supported on the collar 74, has one end 77 formed to engage an ear 78 on the collar 74 and its other end 79 formed to engage the bracket 32. The tension of the spring 76 is such as to urge the upper end of arm 68 to the left, as viewed in Fig. 4, to maintain a roller 80, secured to the arm 68 intermediate of its ends, in engagement with the cam faces 66 and 67 as the member 27 is rotated. As the rod 12, which supports the rotor elements of the transformers, extends freely through a central orifice 81 in the sleeve 30, it is rotatable independently of the disk 27. Thus any movement of the arm 68, caused by the cam faces 66 and 67 engaging the roller 80 on the arm 68, will be transmitted to the plate 73 and collar 74 to which the said plate 73 is secured to cause rotation of the rod 12 for purposes which will presently be described.

Having described in detail the mechanism comprising the dial control of our invention and its association with a multiple arrangement, we will now describe its operation in conjunction with the inductively tuned arrangement herein disclosed. By the present invention the inductances of the secondaries of the transformers T and T′ are simultaneously varied in steps by means of the above described switch arrangement and the inductances of said transformers are varied simultaneously between said steps through the medium of a single control member. With the wipers W and W′ in engagement with the first contact 14 of their respective contact groups and the rotor elements 4 positioned as illustrated in Fig. 2, the rotation of the shaft 39 in a clockwise direction, as viewed in Fig. 1, will cause the worm 40, secured thereto and which is in mesh with the spiral gear teeth 41 on the disk 27, to rotate the said disk 27 in the direction of the arrows shown in Figs. 3 and 4. As before described, the taps from the secondaries of the transformers T and T′ are connected to the contacts 14, adapted to be engaged by the respective wipers W and W′. These taps or steps may be considered as corresponding to zones and as there are seven contacts in each group, each contact may therefore represent a zone.

With the arrangement previously described the movable inductance coils supported on the rotor elements 4 may be simultaneously adjusted within each step or zone. That is, the shaft 12, with the adjustable inductance coils thereon, will be rotated around and back each time a wiper W or W′ is in engagement with one of the contacts 14. As the disk 27 rotates, the ascending cam face 66 of the member 63, secured to the disk 27, engages the roller 80, secured to the arm 68, forcing the same to the right, as viewed in Fig. 4. This movement of the arm 68 to the right rotates the plate 73 and collar 74 in a clockwise direction, as viewed in Fig. 4, due to the link 71 which connects the plate 73 to the arm 68. The collar 74, being fixed to the rod 12, causes the said rod to rotate and as the rotor elements 4 are secured to the rod 12 they will be moved simultaneously through an arc of approximately 90 degrees or until their axes are at right angles to the axes of the stator tubes 2 and 3. This will vary the inductance within the zone corresponding to the contacts 14 engaged by the wipers W and W′.

The member 43, secured to the face 44 of the disk 27, is also rotated but as the roller 55, secured to the arm 50, is in engagement with an extended straight face 48 of the member 43 at this time, the wipers W and W′ remain in engagement with the first contact 14 of each of their respective groups while the rotor elements 4 are being rotated as just described.

As previously explained, each of the seven divisions of the secondaries may be considered a zone representing a particular frequency band. A dial, comprising a suitable strip of celluloid 85, is mounted on the annular shoulder 86 integrally formed on the face 44 of the disk 27. In Fig. 8 is shown the calibrations on a portion of the dial 85 corresponding to one of said zones. As the disk 27 is rotated, the wipers W and W′ are moved at intervals from one contact 14 to the next and the inductances of the transformers are varied between the steps as described above. At the same time the dial 85 is moved so that the calibrations thereon corresponding to the successive zones are disclosed.

As the shaft 39 and disk 27 are rotated to move the wipers W and W′ from one zone to the next, the instant that the roller 80 on the arm 68 passes the apex 87 of the ascending cam face 66, the roller 55 on the arm 50 has finished its travel along the extended face 48 of the member 43 and is moved down under the influence of the spring 56 into engagement with the short face 49 of the member 43. This descending step of the roller 55 permits the arm 50 to move to the right as viewed in Fig. 1, and the wipers W and W′ are also moved a corresponding distance to the right to place their contacting ends in engagement with the next contacts of their respective groups but still permit the wipers W and W′ to remain in engagement with the contacts previously engaged. As the disk 27 continues to rotate, the roller 80 on the arm 68 follows the descending cam face 67 of the member 63 under the influence of the spring 76 and the arm 68 is now moved to the left, as viewed in Fig. 4 to cause the rod 12, supporting the rotor elements 4, to be rotated in a reverse direction to again place the axes of the rotor elements 4 parallel with the axes of their associated stator elements 2 and 3. This position is assumed by the rotor elements 4 when the roller 80 on the arm 68 has reached the bottom 90 of the depression between the ascending and descending cam faces 66 and 67. The instant that the roller 80 on the arm 68 reaches the point 90, the roller 55 on the arm 50 has also reached the end of its travel along the short face 49 and is moved under the influence of the spring 56 down into engagement with the next extended face 48. The arm 50 now moves to the right as viewed in Fig. 1 to disengage the wipers W and W′ from the first contacts 14 and leave them in engagement only with the next contacts 14 which correspond to the next zone. During the time the rotor elements 4 are being moved back to their normal positions with their axes parallel to the axes of the stator elements, the wipers W and W′ remain in engagement with the contact corresponding to the zone they are about to leave and also the next contact in order to disconnect the apparatus by a short circuit during the restoring movement.

The continued rotation of the disk 27 will cause the next ascending cam face 66 of the member 63 to force the arm 68 again to the right, as viewed in Fig. 4, thereby rotating the rotor elements 4 to vary the inductances within this step or zone as before described. During each movement of the arm 68, the wipers W and W′ remain in engagement with the contacts 14 now engaged due to the roller 55 engaging an extended face 48 of the member 43 while the rotor elements 4 are being adjusted to vary the inductance within the zone corresponding to the position now occupied by the wipers W and W′. This operation will be repeated for each contact 14 as the wipers W and W′ are moved from one extreme position to the other.

It will be obvious that the shaft 39 may be rotated in either a clockwise or counterclockwise direction to select a zone and to vary the inductances within a selected zone, as the roller 55 on the arm 50 remains in engagement with the extended cam face 48 of the member 43 while the arm 68 moves to the right or left, under the influence of the cam face 66 or 67 of the member 43 to rotate the rotor elements 4 within the selected zone. When the shaft is rotated in a counterclockwise direction, as viewed in Fig. 1, the operation will be the same as described above except the movement of the parts will be in a reverse direction.

A depending member integrally formed with sub-base 9 cooperates with a stop 96, secured to the face 64 of the disk 27, to so limit the rotation of the disk 27 that the wipers W and W′ may move only from the first to the last of the contacts 14 and vice versa.

While we have illustrated and described the tuning control of our invention with a particular multiple arrangement, it is to be understood that it is applicable to other forms of multiple arrangements. We also do not wish to be limited to the exact structure shown but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

Having described our invention, what we claim as new and desire to secure by United States Letters Patent is:

1. In a device of the class described, a variable inductance device, a zone switch for varying the inductance of said device by steps, a rotor element for varying the inductance of said device between said steps, a single actuating device and mechanism interconnecting said actuating device and said zone switch and rotor element, respectively, for operating said zone switch and said rotor element in a predetermined sequence, said rotor element operating to gradually increase or decrease respectively the inductance as said actuating device is moved to cause said zone switch to increase or decrease the inductance.

2. In a device of the class described, a variable inductance device, a zone switch for varying the inductance of said device by steps, a rotor element for increasing or decreasing the inductance of said device between each step of said switch and the next, means for instantaneously returning the said rotor element to its first position as the said zone switch moves from one position to the next succeeding position, a single actuating device, and means interconnecting said actuating device with said zone switch and said rotor element, respectively, for effecting the operation of said switch and element incident to the operation of said actuating device.

3. In a device of the class described, a transformer comprising a stator coil and a rotor coil adjustably mounted adjacent thereto, taps from said stator coil, contacts to which said taps are respectively connected, a zone switch having a wiper arranged to traverse said contacts, a single actuating member, a pair of cam members carried by said actuating member and means interconnecting said cam members with said zone switch and with said rotor coil, respectively, for moving said wiper intermittently from contact to contact to vary the inductance of said transformer by steps and for moving said rotor coil to vary the inductance of said transformer between said steps, incident to the actuation of said actuating member.

4. In a device of the class described, a transformer comprising a stator coil and a movable coil adjustably mounted adjacent thereto, taps from said stator coil, a series of contacts to which said taps are respectively connected, a zone switch, a wiper for said switch arranged to traverse said contacts, a rotatable operating member, a pair of cam members carried by said operating member and means interconnecting said cam members with said zone switch and with said rotor

coil, respectively, for moving said wiper intermittently from contact to contact to vary the inductance of said transformer by steps and for moving said movable coil to vary the inductance of said transformer between said steps.

5. In a device of the class described, a transformer comprising a stator coil and a movable coil adjustably mounted adjacent thereto, taps from said stator coil, a series of contacts to which said taps are respectively connected, a zone switch, a wiper for said switch arranged to traverse said contacts, a rotatably mounted disk, a pair of cam members carried by said disk, a link member between one of said cam members and said zone switch, a link between the other of said cam members and said movable coil, said cam members and links cooperating upon rotation of said disk to move said wiper intermittently from contact to contact to vary the inductance of said transformer by steps and to move said movable coil to vary the inductance of said transformer between said steps.

6. In a device of the class described, a transformer comprising a stator coil and a rotor coil adjustably mounted within said stator coil, taps from said stator coil, a series of contacts to which said taps are respectively connected, a zone switch, a wiper for said switch arranged to traverse said contacts, a rotatably supported disk, a pair of cam members carried by said disk, means operatively connecting one of said cam members to said zone switch, other means operatively connecting the other of said cam members to said rotor coil, said cam members and means cooperating, upon rotation of said disk, to move said wiper intermittently from contact to contact to vary the inductance of said transformer by steps and to move said rotor coil to vary the inductance of said transformer between said steps.

7. In a device of the class described, a plurality of variable inductance devices, zone switches, one for each of said inductance devices for varying its inductance by steps, rotor elements, one for each of said inductance devices for increasing or decreasing its inductance between each step and the next of its respective switch, means for instantaneously returning the said rotor elements to their first position as the said zone switches move from one position to the next succeeding position, a single actuating device, and means interconnecting said actuating device with said zone switches and said rotor elements, respectively, for effecting the operation of said switches and rotor elements incident to the operation of said actuating device.

8. In a device of the class described, a plurality of transformers each comprising a stator coil and movable coil adjustably mounted adjacent thereto, taps from each of said stator coils, a series of contacts for each of said stator coils to which its taps are respectively connected, zone switches, one for each transformer, a wiper for each switch arranged to traverse the contacts of the corresponding transformer, a single actuating device and means connecting said actuating device to said zone switches and said movable coils, respectively, for moving said wipers intermittently over said contacts to vary the inductances of said transformers by steps and for moving said movable coils to vary the inductances of said transformers between each of said steps and the next.

9. In a device of the class described, a plurality of transformers, each comprising a stator coil and a rotor coil adjustably mounted adjacent thereto, taps from each of said stator coils, a series of contacts for each stator coil to which its taps are respectively connected, wipers, one for each transformer, arranged to traverse the contacts of the corresponding coil, a single operating member, cam members carried by said operating member, means interconnecting one of said cam members with said wipers to move said wipers intermittently from contact to contact to vary the inductances of said transformers by steps, and means interconnecting the other cam with said rotor coils for moving said rotor coils to vary the inductances of said transformers between said steps, both of said means being rendered operative incident to the operation of said actuating device.

10. In a device of the class described, a plurality of transformers, each comprising a stator coil and a movable coil adjustably mounted adjacent thereto, taps for each of said stator coils, series of contacts, one for each stator coil to which its taps are respectively connected, wipers arranged to traverse said series of contacts, respectively, a rotatable operating member, a pair of cam members carried by said operating member and means interconnecting said cam members with said wipers and said movable coils, respectively, for moving said wipers intermittently from contact to contact to vary the inductances of said transformers by steps and for moving said movable coils to vary the inductances of said transformers between said steps.

11. In a device of the class described, a plurality of transformers each comprising a stator coil and a rotor coil adjustably mounted within its associated stator coil, taps from each of said stator coils, series of contacts, one series for each of said stator coils to which its taps are respectively connected, wipers arranged to traverse said series of contacts, respectively, a rotatably mounted disk, a pair of cam members carried by said disk, means operatively connecting one of said cam members to said wipers, other means operatively connecting the other of said cam members to said rotor coils, said cam mem-

bers and means cooperating, upon rotation of said disk, to move said wipers intermittently from contact to contact to vary the inductances of said transformers by steps and to move said rotor coils to vary the inductances of said transformers between said steps.

12. In a device of the class described, a transformer comprising a stator coil and a movable coil adjustably mounted adjacent thereto, taps from said stator coil, a series of contacts to which said taps are respectively connected, a wiper arranged to traverse said contacts, a single operating member, a pair of cam members carried by said operating member, and means interconnecting said cam members with said wiper and said movable coil, respectively, cooperating incident to the operation of said actuating member, to move said wiper intermittently from contact to contact to vary the inductance of said transformer by steps and to move said movable coil to vary the inductance of said transformer between said steps and then restore it to its normal position, the wiper cam being formed to position said wiper in bridge of two adjacent contacts during the restoring movement of said movable coil.

13. In a device of the class described, a transformer comprising a stator coil and a rotor coil adjustably mounted adjacent thereto, taps from said stator coil, a series of contacts to which said taps are respectively connected, a wiper arranged to traverse said contacts, a rotatable operating member, a pair of cam members carried by said operating member, and means interconnecting said cam members with said wiper and said rotor coil, respectively, cooperating incident to the rotation of said operating member to move said wiper intermittently from contact to contact to vary the inductance of said transformer by steps and to move said rotor coil to vary the inductance of said transformer between said steps and then restore said rotor coil to its normal position, the wiper cam being formed to position said wiper in bridge of adjacent contacts during the restoring movement of said rotor coil.

14. In a device of the class described, a transformer comprising a stator coil and a rotor coil adjustably mounted therein, taps from said stator coil, a series of contacts to which said taps are respectively connected, a wiper arranged to traverse said contacts, a rotatably supported disk, a pair of cam members carried by said disk, means operatively connecting one of said cam members to said wiper and other means operatively connecting the other of said cam members to said rotor coil, said cam members and associated means being arranged to cooperate upon rotation of said disk, to move said wiper intermittently from contact to contact to vary the inductance of said transformer by steps and to rotate said rotor coil in one direction to vary the inductance of said transformer between said steps and then return said rotor coil to its normal position, the wiper cam being formed to cause said wipers to take a half step just prior to the reverse movement of said rotor coil to position said wiper in bridge of adjacent contacts during the reverse movement of said coil.

Signed by us, at Chicago, in the county of Cook and State of Illinois, this 8th day of June, 1929.

GEORGE R. EATON.
MORRIS ROSE.