

June 2, 1931.

O. E. MARVEL

1,807,995

ELECTRICAL APPARATUS

Filed March 30, 1925

4 Sheets-Sheet 1

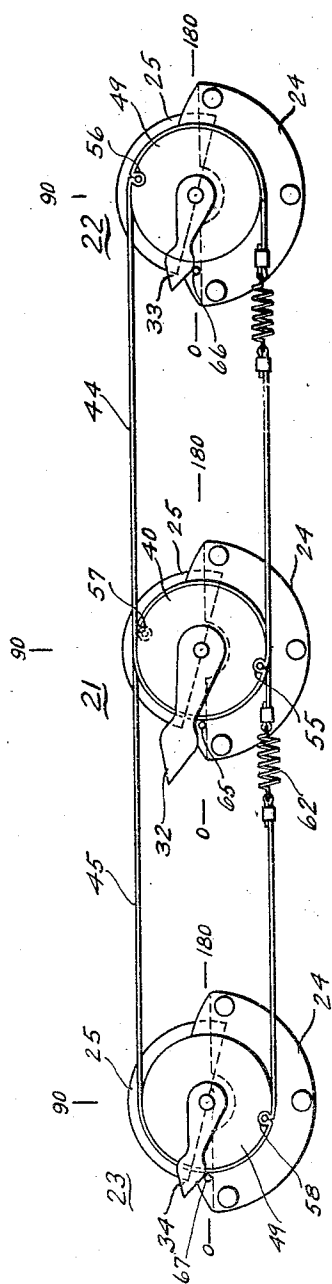


Fig. 2.

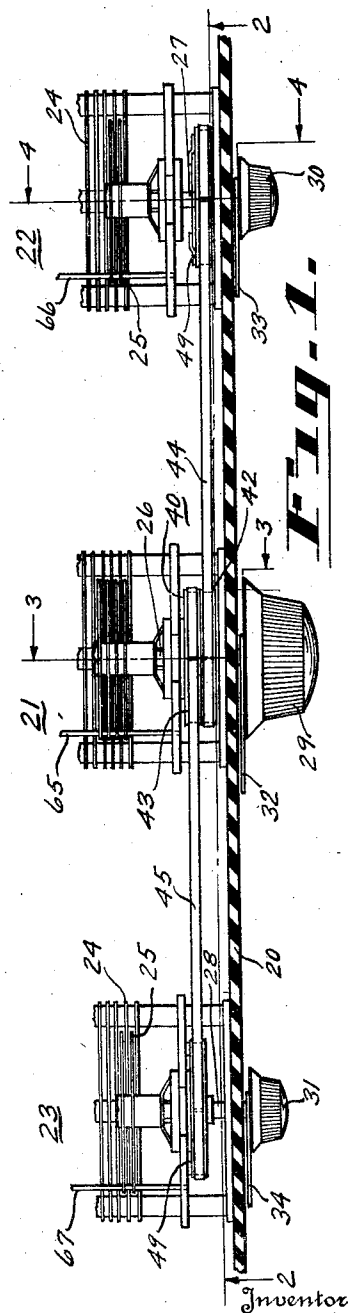


Fig. 1.

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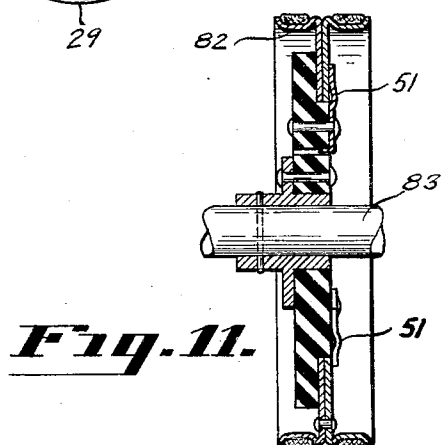
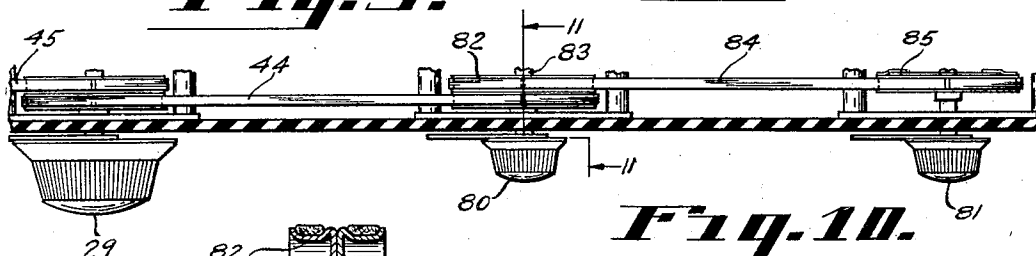
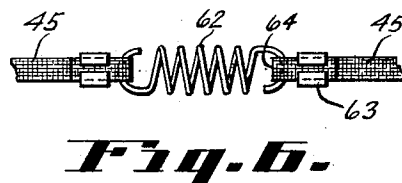
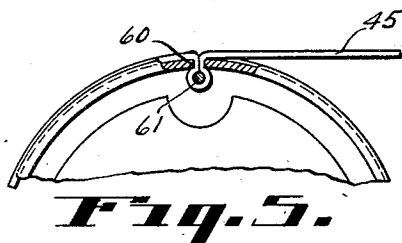
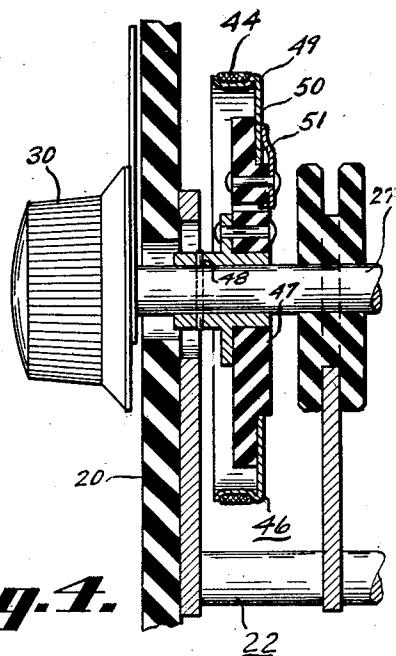
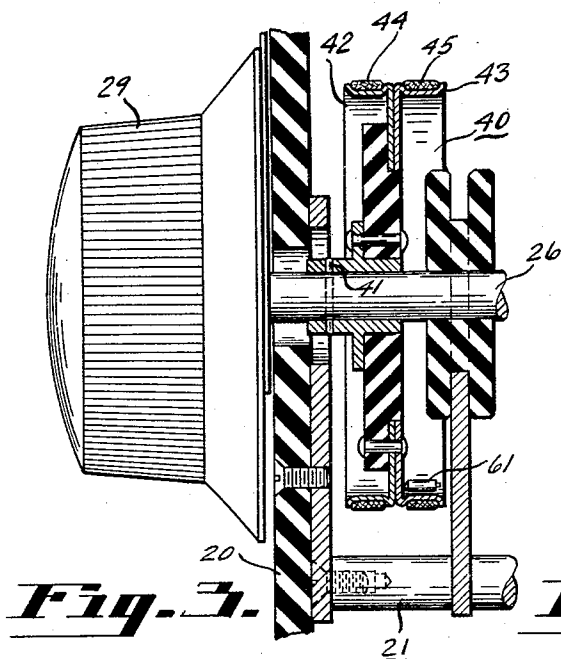
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4 Sheets-Sheet 2



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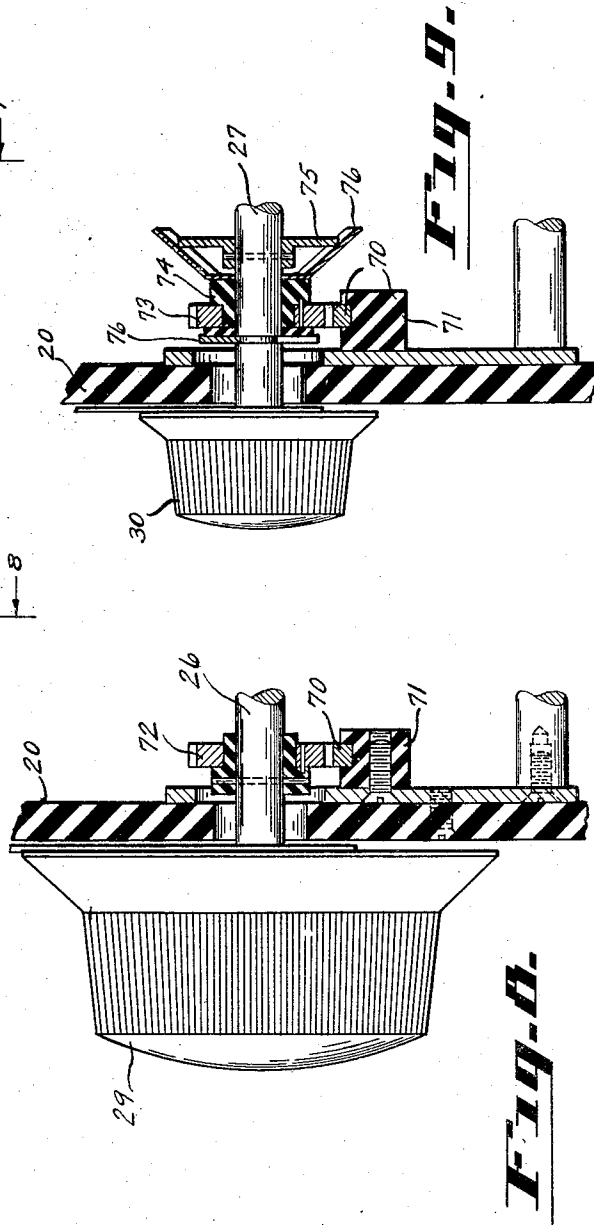
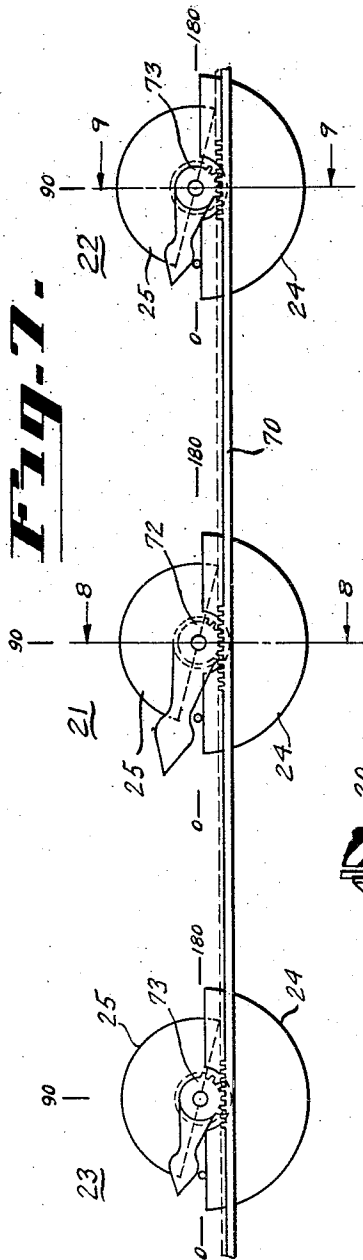
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ELECTRICAL APPARATUS

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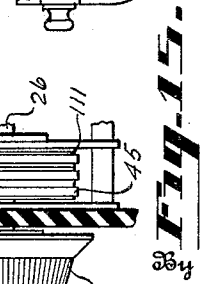
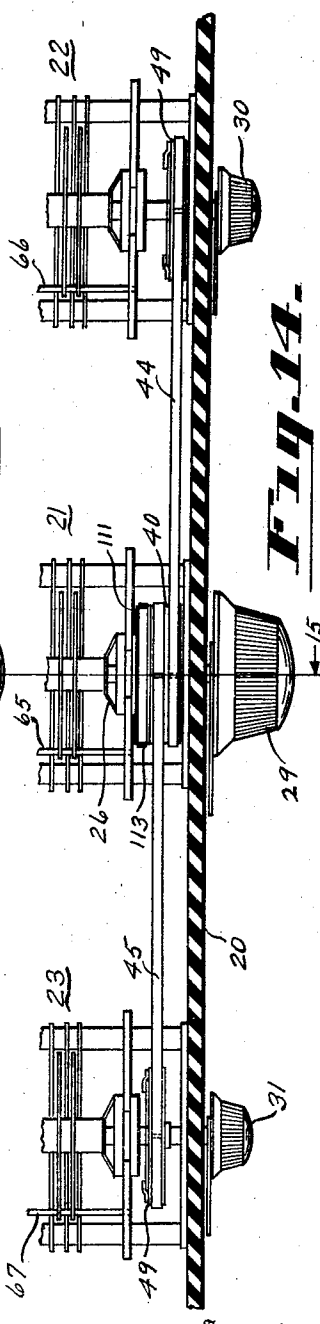
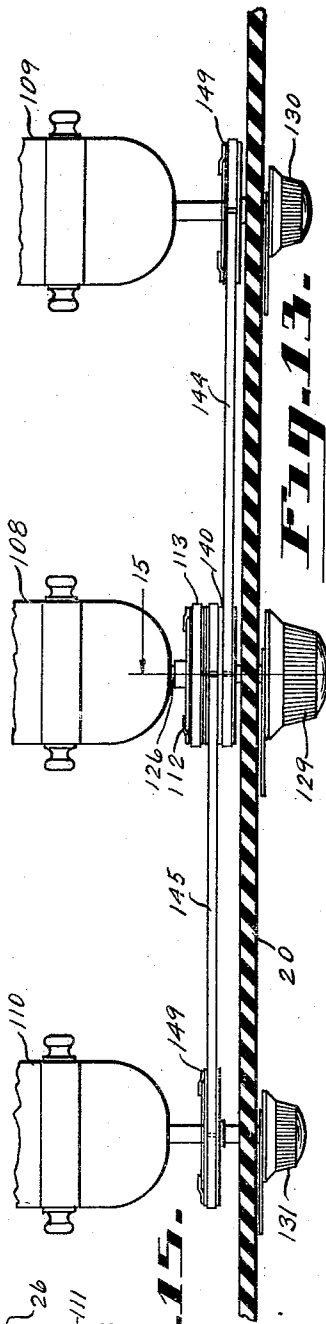
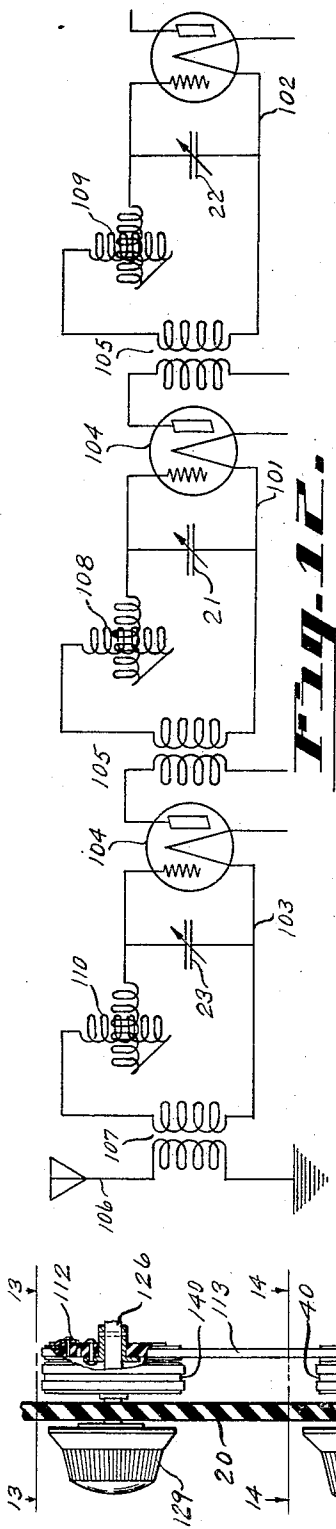
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UNITED STATES PATENT OFFICE

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ELECTRICAL APPARATUS

Application filed March 30, 1925. Serial No. 19,370.

The present invention relates to means for adjusting or controlling a plurality of control devices concurrently or in unison, and is particularly adapted for the control of tuning devices such as are employed in radio apparatus.

One of the principal objects of the invention is to provide a primary or master control for actuating two or more control devices concurrently and for actuating certain of the control devices independently of the others.

Another object is to control a plurality of coordinated control devices in unison or singly and to automatically bring the control devices into coordination with one another after they have been moved out of coordination.

Other objects of the invention will be apparent from the following description when taken in connection with the accompanying drawings, in which—

Fig. 1 is a plan view of a preferred embodiment of the invention, parts being shown in section or broken away;

Fig. 2 is a partly diagrammatic elevation taken on the line 2—2 of Fig. 1;

Figs. 3 and 4 are enlarged vertical sections on the lines 3—3 and 4—4 of Fig. 1;

Figs. 5 and 6 are enlarged views showing details of construction of the apparatus illustrated in Figs. 1 to 4;

Fig. 7 is a view corresponding to Fig. 2 showing a second embodiment of the invention;

Figs. 8 and 9 are enlarged vertical sections corresponding to Figs. 3 and 4 taken on the lines 8—8 and 9—9 of Fig. 7;

Fig. 10 is a plan view of still another form of the invention;

Fig. 11 is a section taken on the line 11—11 of Fig. 10; and

Figs. 12 to 15 show views illustrative of a further adaptation of the invention, Fig. 12 representing in schematic diagram electrical circuits which may be controlled by the means illustrated in Figs. 13 to 15, Figs. 13 and 14 being sectional views along substantially horizontal lines indicated at 13—13 and 14—14 respectively of Fig. 15, and Fig. 15 being

a vertical section taken on the line 15—15 of Figs. 13 and 14.

Referring particularly to Figs. 1 to 6 of the drawings 20 designates the panel of a radio receiving apparatus having mounted thereon a plurality of electrical control devices 21, 22, and 23, which control devices may be means for tuning a plurality of tuned circuits. Such tuning devices may be in the form of condensers or other tuning devices, but for the purpose of the present invention such devices are illustrated as condensers each having fixed condenser plates 24 and movable condenser plates 25 which may be of the usual or conventional form but which are herein illustrated as semi-circular in shape. The movable condenser plates are fixedly mounted upon suitable rotatable shafts 26, 27, and 28 which extend through the panel 20 and are provided with operating handles or dials 29, 30, and 31 respectively. Indicating arms 32, 33, and 34 may be mounted on the rotatable condenser shafts to indicate the relative positions of the fixed and movable condenser plates, and also to indicate (when they point in the same direction) that the movable plates of the several condensers are coordinated with one another.

It will be understood that in the best forms of radio receiving apparatus in which the control devices 21, 22, and 23 are employed for tuning associated tuned circuits, the construction and arrangement of the parts is preferably such that equal angular movements of the several tuning devices or condensers 21, 22, and 23 result in equal changes in the periods or wave lengths of the several tuned circuits controlled thereby. In other words when the indicating arms or pointers 32, 33, and 34 point to zero then all the tuned circuits are tuned to the same frequency, and likewise when the indicating arms point to any other graduation on the panel as for example when they all point to 90, then the several tuned circuits are again tuned to the same frequency. In such an apparatus it is desirable to move or turn the movable elements of the condensers in unison,

and such means is provided by the present invention, as will now be described.

Referring to Figs. 3 and 4, 40 denotes a double driving pulley having a hub which is pinned to the condenser shaft 26 at 41. This pulley is provided with double rim portions 42 and 43 which are preferably grooved to receive thereon driving belts 44 and 45. The rim portions 42 and 43 are suitably insulated from their hub and from the condenser shaft 26. Secured to the shaft of each of the condensers 22 and 23 is what may be termed a driven pulley 46 which consists of an insulating hub portion 47 pinned to the condenser shaft at 48 a preferably grooved rim portion 49 mounted upon the circumferential edge of the insulated hub 47. As best shown in Fig. 4 the rim 49 comprises a disk portion 50 having a circular aperture therein for receiving the hub 47. The rim 49 is maintained in frictional engagement with the hub 47 by means of a number of spring supporting members 51 disposed about the circumference of the hub 47, the connection being such that rotational movement of the rim 49 is transmitted to the condenser shaft 27 to cause a corresponding movement thereof. Movement of the condenser shaft 27 and hence movement of the condenser plates mounted thereon may be effected independently of the other condensers by turning the secondary control dial 30, the resistance to movement of the rim 49, by reason of its connection with another pulley, being such as to hold the rim 49 immovable while the shaft 27 is being turned.

As best shown in Fig. 1, the pulley rim 42 of condenser 21 is connected with the pulley rim 49 of the condenser 22 by belt 44, and the pulley rim 43 is connected with the pulley rim 49 of condenser 23 through belt 45. By this connection it is possible through rotation of the primary or master control dial 29 to rotate the several pulleys in unison, the pulleys 49 being driven from the double rimmed driving pulley 40 which is carried upon the shaft of condenser 21. To maintain the proper driving connection between the belts 44 and 45 and the several pulleys, the belts are preferably fixed to the pulleys at certain points; though it will be understood that this is not essential. Thus as shown in Fig. 2 the belt 44 is fixed to the pulley 40 at 55 and it is secured to the pulley 49 of condenser 22 at 56. Likewise the belt 45 is secured to the pulley 40 at 57 and to the pulley 49 of condenser 23 at 58.

The form of condenser herein employed is one of the type which is intended to rotate through 180° and the points of attachment of the belts with their respective pulleys are therefore so located that when the indicating arms point to zero the points of attachment lie in vertical lines passing through shafts of the condensers. Thus when indicating arms

32 point to zero the point of attachment 55 is directly below the shaft of condenser 21 while the point of attachment 56 is directly above the shaft of the condenser 22. As the condenser shafts are rotated 180° to the right the point of attachment 55 moves to a position immediately above the shaft in condenser 21 while the point of attachment 56 moves to a position immediately below the shaft of condenser 22. The belts are thus connected with the pulleys in such a manner as to not interfere with the free rotational movement of the pulleys and attached condenser plates through the desired angle.

Each pulley rim is provided, at the point of attachment of the belt, with a transverse slot 60 as best shown in Figs. 3 and 5. To attach the belt, the latter is doubled upon itself and the doubled end inserted through the slot after which a pin 61 is inserted through the loop formed by the doubled portion of the belt, and the belt is then drawn tight so as to bind the pin 61 in position. The slot 60 is preferably of such proportions as to hold the belt frictionally against sliding therein, so that even if the belt should break the pin 61 will be held against falling out of the loop. Obviously, if desired, the pin may be permanently secured to the pulley in any suitable manner. The belt is constructed of material which is flexible but which does not readily stretch and for this purpose a belt of woven fabric has been found to give good results. However, should any stretching of the belt occur, this may be taken up by means of a spring or other elastic means 62 which serves to hold the belt taut, so that upon rotation of the primary or master control dial 29 the several pulleys will be caused to move in unison without any back-lash or lost motion. One method of securing the spring 62 is illustrated in Fig. 6 wherein the ends of the belt 45 are folded over and secured by means of clips 63 to form loops 64 for receiving the spring 62.

From the foregoing it will be apparent that the present invention provides means by which the several movable elements of the tuning devices of a radio receiving apparatus may be moved or adjusted in unison whereby the periods of the several tuned circuits may be adjusted simultaneously and alike. When the several indicating arms all point in the same direction the condensers are said to be coordinated, and it will be apparent that during movement of the condensers in unison the condensers will remain coordinated with one another. Owing to slight mechanical or electrical imperfections in an apparatus, or variations in the construction thereof, it is sometimes desirable to move one of the tuning devices to a small extent, say one or two degrees, in order to obtain the best results or the clearest reception. The present invention also provides means for accomplishing

such minor or secondary adjustments. By turning either of the readily accessible and readily operable secondary control dials 30 or 31 the condensers 22 and 23 may be given slight adjustments independent of one another and independent of the condenser 21, and this without holding or otherwise locking either the master dial 29 or the other secondary control dial. When thus adjusted the condensers 22 and 23 are no longer coordinated with the condenser 21 in a mechanical sense. When it is desired to tune the receiving apparatus to a different wave length or period the primary control dial 29 is operated to move the several condensers in unison, and here again it may be desirable to give the condensers 22 and 23 minor adjustments to obtain the clearest reception. However, since the extent of adjustment of the condensers 22 and 23 which may appear desirable may vary somewhat in amount or in direction at the different wave length settings of the primary control dial 29, it is generally preferable to return the several condensers into coordination with one another before they are moved from one position to another. To facilitate such coordination the condensers are provided with stop means or pins 65, 66, and 67, extending transversely to the plane of the condenser plates and lying against or adjacent the radial edge portion of the fixed condenser plates 24.

To coordinate the movable elements or plates of the condensers the main control dial 29 is turned to the left until its movable plate 25 strikes the stop 65. If the movable plate 25 of condenser 23 is in advance of the movable plate of condenser 21 then the former will strike the stop 67 and be held against further rotation to the left until the condenser 21 strikes its stop 65. Likewise if upon rotation to the right the condenser 22 is in advance of the condenser 21 then its movable plate 25 will strike the stop 66 and be held against further rotation until the movable element 25 of condenser 21 strikes the stop 65. If both of the condensers 22 and 23 are in advance of the condenser 21 in the same direction then the several condensers may be brought into coordination by simply turning the main control dial 29 in one direction, but in any event the several condensers may always be brought into coordination by turning the main control dial 29 in both directions until it strikes the stop 65.

In Figs. 7, 8, 9 there is illustrated a second embodiment of the invention in which the condensers are actuated in unison by means of a suitable rack and pinion connection, the general arrangement and method of operation being similar to that illustrated in Fig. 1. In this form of the invention a rack 70 is supported upon suitable guide blocks 71 secured to the panel 20 and is adapted to slide longitudinally upon the supporting

blocks 71. A driving pinion 72 is pinned to the shaft 26 of condenser 21 whereby upon rotation of the main control dial 29 the rack 70 will be given a longitudinal sliding movement in the guide blocks 71. The condensers 22 and 23 are connected in driving connection with the rack 70 through a friction clutch arrangement, a preferred construction being illustrated in Fig. 9. In this figure 73 is a pinion carried by an insulating hub 74 loosely mounted upon the condenser shaft 27. A plate or washer 75 is pressed on the shaft 27 or pinned thereon as illustrated and a spring tension member 76 having spring arms is interposed between the hub 74 of the pinion and the disk 75 to establish a frictional connection between the shaft 27 and the pinion 73. The hub 74 and pinion 73 are held against longitudinal movement on the shaft 27 in a direction away from the disk 75 by means of a shoulder formed on the shaft which shoulder may be in the form of a C washer 76 secured to the shaft.

In this form of the invention the several condensers may be moved in unison by turning the main control dial 29 and the condensers 22 and 23 may be adjusted independently of the condenser 21 by turning their respective dials as will be apparent from the drawings.

According to the present invention any number of control devices, such as condensers, may be controlled from the single or master control dial 29. One arrangement is illustrated in Figs. 10 and 11 wherein 29 designates the main control dial while 80 and 81 designate secondary control dials. In this form of the invention several secondary control devices may be connected with and operated from the main control dial 29 through the belts 44 and 45 mounted as already described in connection with Figs. 1 and 2. Mounted upon the shaft of such secondary control device, as for example the device 80, is a double pulley 82 which is mounted upon and has a slidable frictional connection with its shaft 83, the connection being illustrated in Fig. 11. The double pulley 82 is connected by means of a belt 84 with single pulley 85 mounted upon the shaft of control device 81 there being a suitable frictional connection between the pulley 85 and the shaft of the control device 81 to permit independent movement of the latter. It is obvious that by mounting a double pulley upon the shaft of control device 81 such double pulley having a frictional connection with its shaft, the movement of the main control dial 29 may be transmitted to still other control devices beyond the control device 81.

The number of control means and circuits that may thus be controlled from a single dial is thus unlimited and may be varied to any desired extent within the scope of this invention merely by the application, extension

or rearrangement of the means herein disclosed. A further such application of the invention is illustrated in Figs. 12 to 15 in which Fig. 12 illustrates by a schematic diagram the circuits of a radio apparatus, which circuits may be controlled in unison or independently in accordance with the present invention. Referring to this figure reference characters 101, 102, and 103 denote a series of resonant or tuned circuits, these circuits being connected in cascade through the medium of vacuum tubes or electron discharge devices 104 and transformers 105 connected in a manner which is well understood by those skilled in the art. The first resonant circuit 103 may be connected with an antenna circuit 106 through the medium of a transformer or coupler 107, which may or may not be variable. The circuits 101, 102, and 103 are provided with the variable inductances or variometers 108, 109, and 110 respectively, and are also provided with the variable condensers 21, 22, and 23 respectively. Each of the circuits 101, 102, and 103 may thus be tuned by varying its inductance or by varying its capacity or by varying both of these factors conjointly.

Figs. 13 to 15 illustrate means for controlling or varying the variable inductances and the variable condensers of the circuits 101, 102, and 103 in unison or for varying these devices or factors independently of one another. Referring first to Fig. 14 there is shown a primary or master control dial 29 and secondary control dials 30 and 31 for controlling the condensers 21, 22, and 23, the general construction and arrangement being similar to that illustrated in Fig. 1 except in the particulars hereinafter pointed out. Fig. 13 illustrates means for controlling or varying the variable inductances or variometers 108, 109, and 110 in unison or independently. The arrangement here is similar to that illustrated in Figs. 1 and 14, the variometer 108 carrying on its shaft a double pulley fixed thereon and the variometers 109 and 110 carrying single pulleys 149 which are in frictional driving engagement with their shafts. The pulleys 140 and 149 are operatively connected by the belts 144 and 145 in the manner previously described. Upon operation of the dial 129 the several variometers 108, 109, and 110 are moved in unison, and each of the variometers 109 and 110 may be varied independently by operation of its control dial 130 or 131 respectively, as will be readily understood.

As best shown in Fig. 15, means is provided for interconnecting the condenser controls and the variometer controls whereby all these control or tuning means may be operated in unison. For this purpose the shaft 26 of the master or primary control 29 is provided with a single pulley 111 which is rigidly secured thereon for rotation therewith. The shaft

126 of the control 129 carries a single pulley 112 which has slidable frictional connection with the shaft 126 the connection being similar to that illustrated in Fig. 4. The pulleys 111 and 112 are operatively connected through the medium of a belt 113.

In the operation of this form of the invention all the variometers and variable condensers may be varied in unison by movement of the master or primary control dial 29. Movement of the dial 29 is transmitted to the condensers 22 and 23 through the belts 44 and 45 respectively, and likewise such movement is transmitted through the belt 113 to the double pulley 140 of the upper bank or unit of control devices, from which pulley 140 the movement is transmitted through the belts 144 and 145 to the variometers 109 and 110 respectively. The frictional connection between the pulley 112 and the shaft 126 of the variometer 108 is such that any movement of the master control dial 29 is conveyed to the shaft 126 and thus transmitted through the double pulley 140 to the several variometers. Should it be desired to make independent adjustments of the condensers 22 and 23, this may be done by operating the secondary control dials 30 and 31, and likewise independent adjustments of the variometers 109 and 110 may be effected by operation of the secondary control dials 130 and 131. In this connection, it will be understood, of course, that the variometers 108, 109, and 110 are provided with suitable stop or coordinating means, such means corresponding in function and general principle of operation with the coordinating means of the condensers 21, 22, and 23 and therefore not being illustrated. If desired, the condensers may be actuated in unison and independently of the variometers by moving the master control dial 29 with one hand while holding the control dial 129 against movement with the other hand, and in a similar manner the variometers may be moved in unison by actuating the control dial 129 while holding the master control 29 against movement. Such relative movements of the dials 29 and 129 is permitted through the frictional connection of the pulley 112 with its supporting shaft 126, as will be readily understood. When the variometers are moved in unison by operation of the control dial 129, this dial has the relation of a primary or master control with reference to the secondary control dials 130 and 131 of the variometers 109 and 110. But with respect to the master control dial 29 the control 129 may be considered as a secondary control although it is preferably constructed intermediate in size between the master control 29 and the other secondary controls to indicate that it has the functions, under certain conditions, of an intermediate control, or a master control with reference to the several variometers. If desired, the dial 129

may be used as the master dial for controlling all the tuning devices.

The form of the invention by which the capacity and inductance of the several resonant circuits may be varied in unison or independently is particularly valuable where it is desired to maintain the circuits at a high efficiency for all frequencies within the range of the apparatus. It is well understood that the resonance frequency of a circuit varies directly as the product of the capacity and the inductance of the circuit and as a consequence the frequency may be varied by changing either the capacity or the inductance. However, the power factor of the circuit is at maximum or unity value only when the capacity and the inductance of the circuit are equal, that is, when the quotient of the capacity and the inductance is unity. It is apparent, therefore, that the capacity and the inductance of a circuit should be changed simultaneously and equally to maintain the circuit at unity power factor, and further that any other method of adjustment of the circuit, as for example, the adjustment of the capacity alone while holding the inductance fixed, has the effect of decreasing the power factor of the circuit. According to the present invention the capacity and the inductance of the several circuits may be varied in unison so as to maintain the circuits at unity power factor, a feature which is of importance in securing the best results, particularly where the circuits are intended to receive signals having a frequency of more than one million cycles per second, signals of this frequency being at the present time commonly termed low wave length signals.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. An apparatus of the character described comprising a pair of tuning devices each having a rotatably movable element, and control means for controlling the movements of said movable elements, said control means comprising a pair of pulleys each mounted for rotation concentrically with respect to a movable element, a belt for connecting said pulleys in driving relation with one another, frictional driving connections between said pulleys and said movable elements whereby movement of one of said pulleys is transmitted to both of said movable elements, one of said driving connections being so constructed and arranged as to permit the corresponding movable element to be moved independently of the other movable element while the latter remains free.

2. An apparatus of the character described comprising a pair of tuning devices each having a rotatable tuning element, and control means for controlling the movements of said rotatable tuning elements, said control means comprising a pair of pulleys mounted for rotation coaxially with respect to said elements, a belt fixedly secured to said pulleys for connecting said pulleys in driving relation with one another, driving connections between said pulleys and said movable elements whereby movement of one of said pulleys is transmitted to both of said movable elements, one of said driving connections being a constant frictional drive permitting the corresponding movable element to be moved independently of the other movable element while the latter remains free.

3. An apparatus of the character described comprising a pair of tuning devices each having a movable element, and control means for moving said movable elements in unison, said control means comprising a pair of pulleys each connected with one of said movable elements, a belt riding on said pulleys and secured thereto at diagonally opposite points, and means for maintaining said belt taut, the driving connection between one of said pulleys and its corresponding movable member being such as to permit independent movement of said movable member.

4. An apparatus of the character described comprising a pair of tuning devices each having a movable element, and control means for moving said movable elements in unison, said control means comprising a pair of pulleys each connected with one of said movable elements, a belt riding on said pulleys to interconnect the same, and a yielding element connected in said belt to maintain the same taut, the driving connection between one of said pulleys and its corresponding movable member being such as to permit independent movement of said movable member.

5. An apparatus of the character described comprising a pair of control devices each having a movable element, primary means for moving said elements in unison, a secondary means for moving one of said elements independently of the other, and stop means for a rotatable element adapted upon movement of the primary means to a predetermined position to coordinate said movable elements to a definite normal relationship with respect to one another.

6. An apparatus of the character described comprising three or more control devices each having a movable element, a single primary means for moving said elements in unison, said primary means having a fixed connection with one of said movable elements, secondary means for moving the remaining movable elements independently of the primary means, and stop means adapted

upon movement of said primary means to one or both of two predetermined positions to bring all said movable elements into coordination with one another in a definite normal relationship with respect to one another.

7. Apparatus of the character described comprising a pair of tuning condensers each having a movable plate and a fixed plate, primary control means for moving said movable plates in unison, secondary control means for moving one of said movable plates independently of the other movable plate, and stop means in the path of movement of said movable plates to bring the same into coordination with one another in a definite normal relationship with respect to one another upon the movement of said primary control means to a predetermined position.

8. Apparatus of the character described comprising a pair of tuning condensers each having substantially sector-shaped movable and fixed plates, primary control means for moving said movable plates in unison, secondary control means for moving one of said movable plates independently of the other movable plate, and stop means in the path of movement of said movable plates to bring the same into coordination with one another upon the movement of said primary control means to a predetermined position, said stop means comprising an abutment adjacent the radial edge of one of said plates and in the path of movement of the radial edge of the other plate.

9. An apparatus of the character described having a resonant circuit, adjustable tuning means in said circuit comprising a plurality of movable elements, primary means for moving said movable elements in unison, secondary means for moving one of said movable elements independently of the other movable element, and stop means for coordinating said movable elements to a definite normal relationship with respect to one another.

10. In an apparatus of the character described, a plurality of resonant circuits, a plurality of tuning means in said circuits, primary means for adjusting said tuning means in unison, secondary means for adjusting one of said tuning means independently of the other tuning means, and means for bringing the tuning means which is controlled by said secondary means to a predetermined definite relationship with respect to the other tuning means for coordinating the several tuning means.

11. In an apparatus of the character described, a plurality of resonant circuits, a plurality of tuning means in said circuits, primary means for adjusting said tuning means in unison, secondary means for adjusting one of said tuning means independently of the other tuning means, and means operable merely by the operation of said primary

means to automatically coordinate the several tuning means.

12. In a radio receiving apparatus, a series of tuning condensers having movable plates rotatable about spaced parallel axes, a rotatable member for controlling each condenser, one of said members having a positive driving connection with its corresponding condenser, a control pulley connected to the movable plates of each condenser coaxially therewith, and a series of belts connecting each pulley to an adjacent pulley to provide for equal and similar movement of all said condensers when said one member is moved, and a spring connected in each belt to maintain the same taut.

13. A radio tuning device comprising a pair of tuning devices each having a movable element, and control means for moving said movable elements in unison, said control means comprising a pair of pulley drums each connected with one of said movable elements, a belt riding on said pulleys and secured thereto at diagonally opposite points so as to permit 180° rotation of said pulley drums in a definite predetermined relationship.

14. A radio tuning device comprising a pair of tuning devices each having a movable element, and control means for moving said movable elements in unison, said control means comprising a pair of pulley drums each connected with one of said movable elements, a belt riding on said pulleys and secured thereto at diagonally opposite points so as to permit 180° rotation of said pulley drums in a definite predetermined relationship, and a spring interposed in said belt for maintaining the same taut.

15. A radio tuning device comprising a pair of tuning devices each having a movable element, and control means for moving said movable elements in unison, said control means comprising a pair of pulley drums each connected with one of said movable elements, said drums being each provided with a transverse slot, a belt riding on said drums and having portions held within said slots so that said pulley drums are secured at diagonally opposite points to the belt to permit 180° rotation of said pulley drums in a definite predetermined relationship.

16. In a radio receiving apparatus, a plurality of adjustable tuning circuits each circuit having one or more tuning devices and at least one of said circuits having a condenser tuning device, a single means for adjusting the several tuning devices of said last mentioned circuit and of said circuits in unison, and means for adjusting the several devices of said last mentioned circuit and of said circuits independently of one another.

17. An apparatus of the character described comprising a pair of tuning devices

each having a rotatable tuning element and control means for controlling the movements of said rotatable tuning elements, said control means comprising a pair of pulleys mounted for rotation coaxially with respect
5 to said elements, a belt interconnecting said pulleys in driving relation with one another, driving connections between said pulleys and said movable elements whereby movement of one of said pulleys is transmitted to both of
10 said movable elements, one of said driving connections being a constant frictional drive permitting the corresponding movable element to be moved independently of the other movable element while the latter remains
15 free, and a control knob connected to said corresponding movable element.

In testimony whereof I hereto affix my signature.

ORIN E. MARVEL.

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