Sept. 3, 1929. D. F. ASBURY 1,726,876

RADIO APPARATUS

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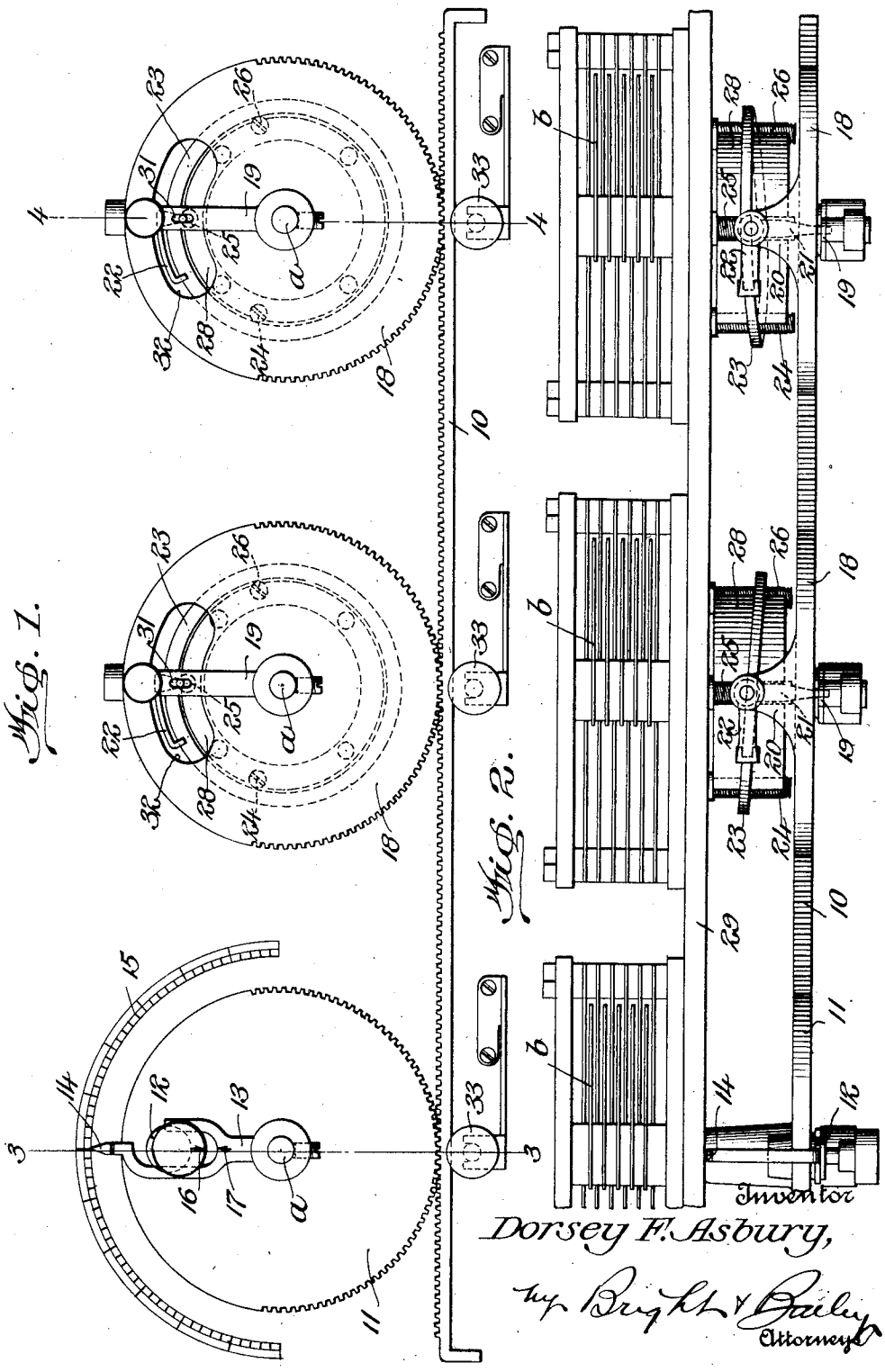


Fig. 1.

Fig. 2.

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Fig. 3.

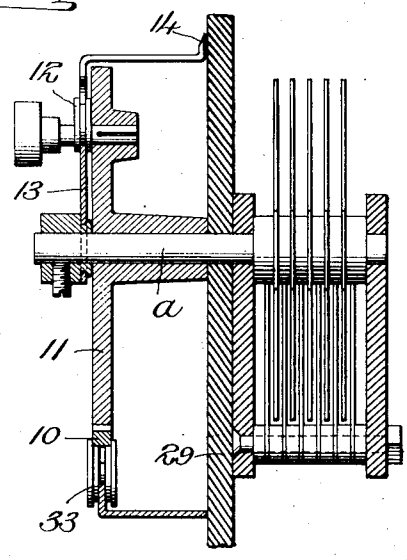


Fig. 4.

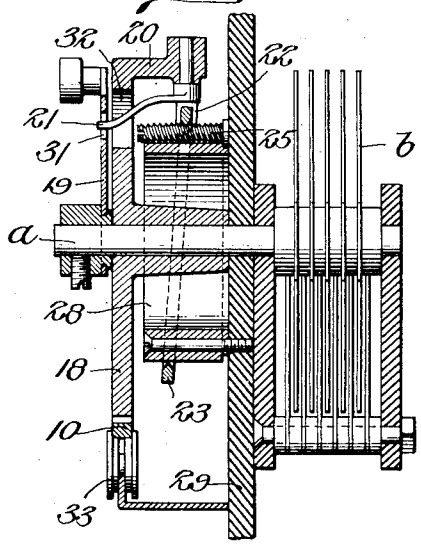


Fig. 5.

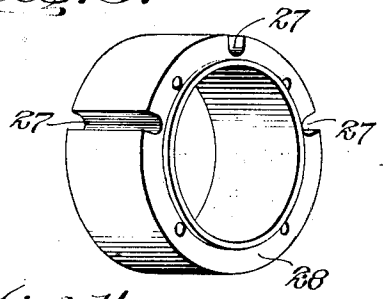


Fig. 6.

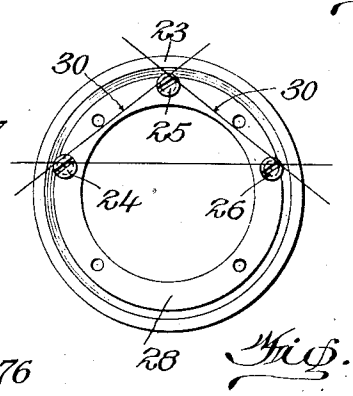


Fig. 7.

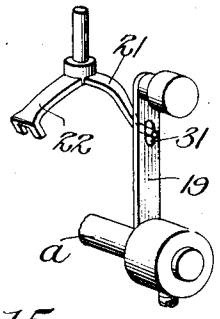


Fig. 14.

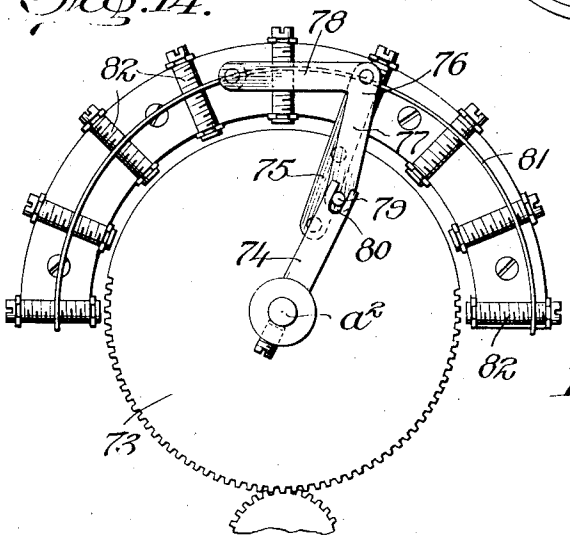
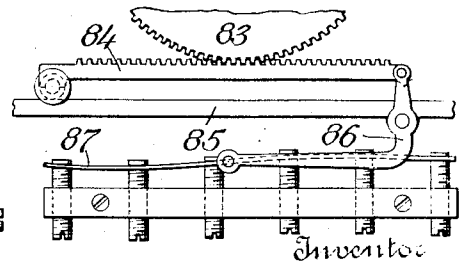


Fig. 15.



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RADIO APPARATUS

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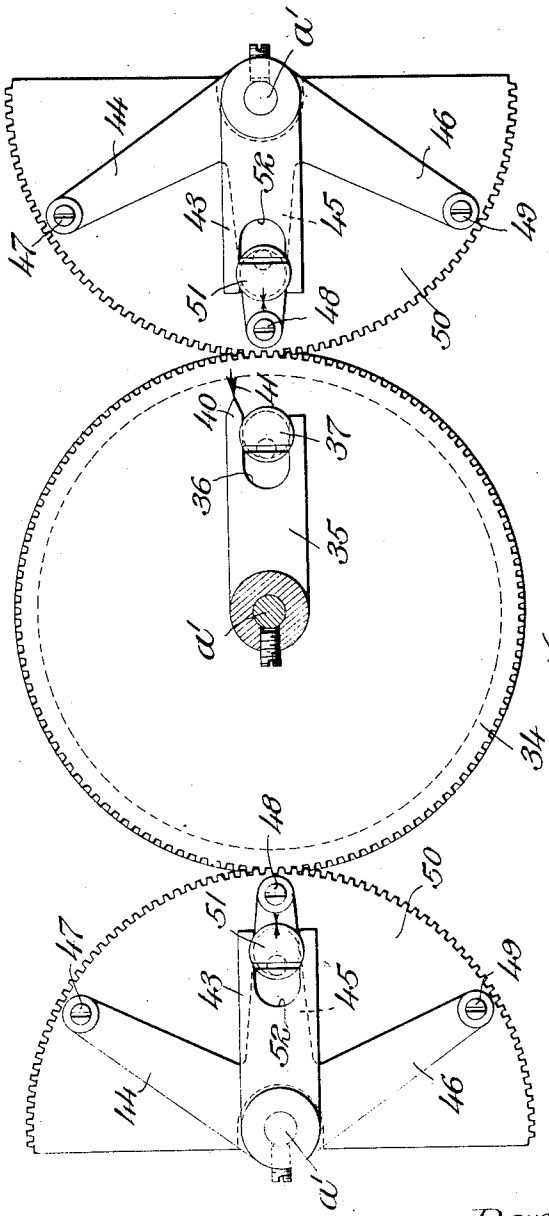


Fig. 8.

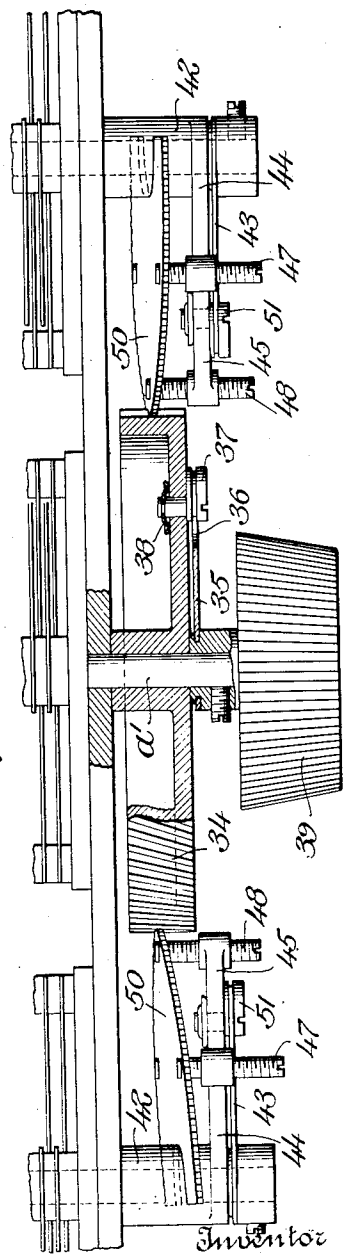


Fig. 9.

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RADIO APPARATUS

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Fig. 10.

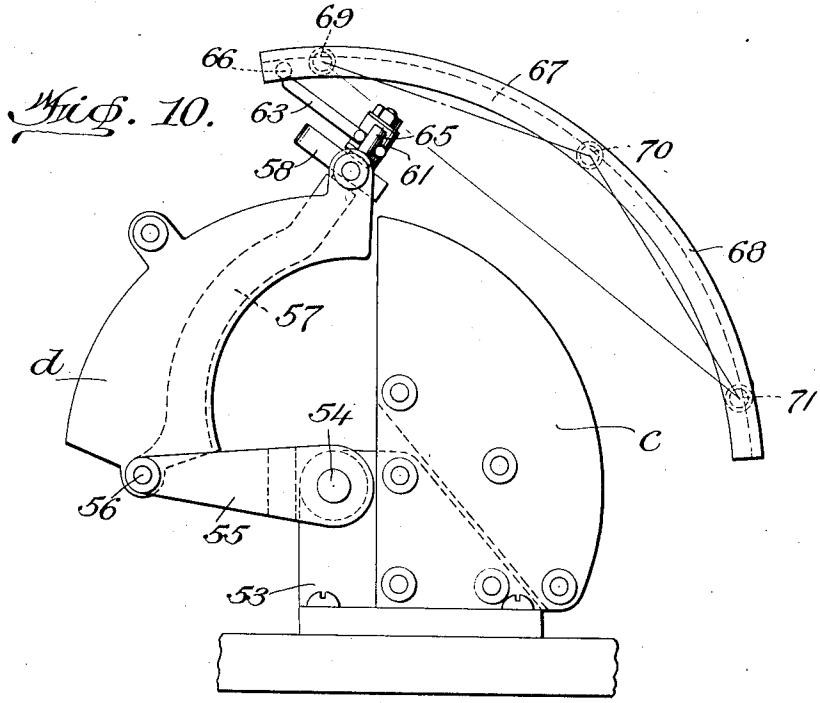


Fig. 11.

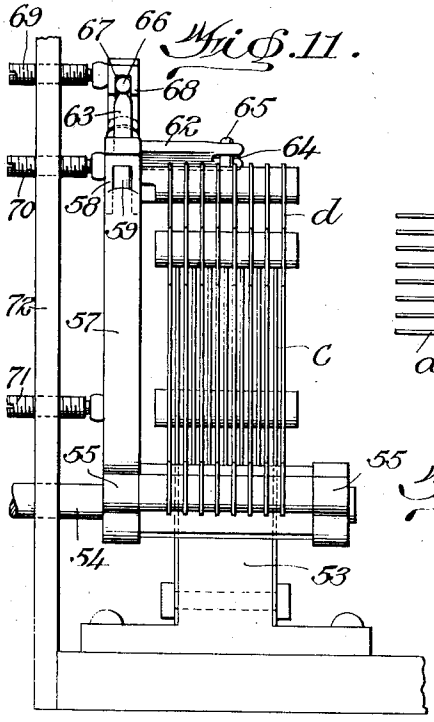


Fig. 12.

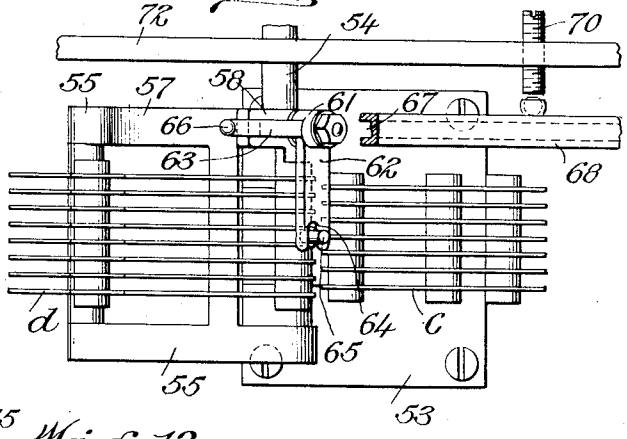
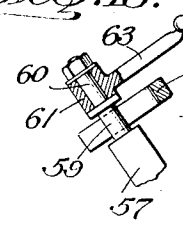


Fig. 13.



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Patented Sept. 3, 1929. 1,726,876

UNITED STATES PATENT OFFICE.

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RADIO APPARATUS.

Application filed May 10, 1926. Serial No. 108,074.

My invention relates to radio apparatus, and my purpose, generally speaking, is to provide improvements in operating means for tuning devices, whereby a plurality of tuning devices, when connected together by a common operator for collective operation, and when operated collectively, may be caused to tune simultaneously and accurately with different wave lengths, without the necessity of individually adjusting the units.

More particularly it is my purpose to provide a simple, inexpensive, easily operated means of accomplishing the result mentioned, to which end my improvements consist in the provision of a mechanism whereby the tuning units of a radio apparatus may be pretuned accurately with respect to certain wave lengths, a low, an intermediate and a high wave length for example, and substantially accurately with respect to all other wave lengths, without bending or otherwise deforming any member of the mechanism and by means of a few simple adjustments, thus to avoid some of the structural complications and the relatively high cost of producing an apparatus for a similar purpose in accordance with the disclosures in my prior applications 72,514; 80,833; 89,441; 89,442; 89,443 and 95,138. In other words, it is my aim to provide a simple, cheap, readily adjustable and easily operated mechanism whereby the tuning units of a radio apparatus may be pretuned sufficiently close with all wave lengths to satisfy all commercial requirements, without the necessity of making a multitude of adjustments in the mechanism to cause it to pretune the units accurately with each and every wave length as is contemplated by the mechanisms disclosed in my aforesaid prior applications.

My present inventive idea is capable of embodiment in different mechanical structures, certain of which are illustrated in the accompanying drawings, but it is to be understood that the structures shown are intended merely as disclosures of my invention in certain preferred forms and that its scope is as defined in the appended claims.

In the drawings, wherein like characters of reference denote corresponding parts in the different views:

Fig. 1 is a front elevation of a plural tuning unit radio apparatus showing a preferred form of my invention embodied therein;

Fig. 2, a plan view of the structural arrangement shown in Fig. 1;

Fig. 3, a transverse section on the line 3—3 of Fig. 1;

Fig. 4, a transverse section on the line 4—4 of Fig. 1;

Fig. 5, a perspective of the control member support;

Fig. 6, an elevation of the control member support with the control nember mounted thereon;

Fig. 7, a perspective of the lever mechanism for connecting the control member with the movable part of a tuning unit;

Fig. 8, a view similar to Fig. 1 showing a modification of my invention in which the control members are in the form of toothed plates cooperating with a spiral gear;

Fig. 9, a plan view, partly in section, of the mechanism illustrated in Fig. 8;

Fig. 10, an elevation showing another modified form of my invention in which the control member cooperates with a lever arrangement to produce movement of the movable part of a tuning unit at variable velocities in one direction while said part is being moved at a constant velocity in another direction;

Fig. 11, an end view of the structural arrangement illustrated in Fig. 10;

Fig. 12, a top plan view of the structural arrangement illustrated in Fig. 10;

Fig. 13, a detail view showing the manner of mounting the lever mechanism of Figures 10 to 12;

Fig. 14, an elevation showing a further modification of my invention; and

Fig. 15, an elevation showing still another modification of my invention.

Referring to the drawings in detail, particularly to Figures 1 to 7, it will be observed that I have shown my invention embodied in a receiving set employing three tuning units in the form of variable plate condensers, each including, as usual, a shaft *a* carrying a set of rotor plates *b*. It will be observed, also, that I have shown said condensers arranged in a row along a straight line so as to be collectively operable by a straight rack bar 10, but it is to be understood that instead of variable plate condensers the tuning units may be in the form of coils or other capacity or inductance devices, and that, instead of being arranged and operated as herein shown, they may be arranged in any other desired rela-

tion, as shown in Fig. 1 of my application 72,514, for example, and operated collectively in any other desired manner, by a pinion for instance or as shown, for example in my application #89,442.

My invention contemplates the provision of means whereby, in a collectively operated plural tuning unit apparatus, irrespective of the number of units employed, movement of an operator at a constant velocity may be caused to produce movement of the movable parts of the units at variable velocities to cause all units to tune simultaneously with each different wave length encountered by the units during their collective operation. Accordingly one of the units may be moved at a constant velocity and need not be equipped with any variable speed mechanism. If it is not equipped with such mechanism, however, it preferably is provided with means whereby it may be adjusted to tune accurately with some one wave length without moving the collective operator or the movable parts of the other units, in order that the apparatus, when it is pretuned for all wave lengths, may be caused to bear a predetermined relation to graduations on a wave length scale associated with one of the units. Of course, each of the units might be equipped with variable speed mechanism, but as this would be unnecessary duplication in respect to one of the units, I preferably equip all but one of the units with variable speed mechanism and provide the remaining unit with means for individually adjusting same to tune accurately with some particular wave length as a base or starting point for pretuning the other units whereby, as aforesaid, a predetermined relation will be caused to exist between the units as tuned with different wave lengths and a wave length scale provided in association with one of the units.

In accordance with the foregoing the shaft *a* of one of the units has loosely mounted thereon, for rotation with respect thereto, a gear 11 carrying an eccentric 12, while affixed to said shaft is an arm 13 having a slot therein which receives said eccentric, the result being that if gear 11 is held against rotation and eccentric 12 is rotated, it will react from said gear through said arm to rotate shaft *a*, while on the other hand, if gear 11 is rotated, shaft *a* will be caused to rotate therewith due to the interlock between said gear and shaft provided by eccentric 12, it being noted in this connection that the eccentric is prevented from rotating with respect to gear 10 when the latter is rotated due to frictional resistance between the eccentric shaft and the gear 11 provided by splitting said eccentric shaft as shown in Fig. 3 to provide resilient tongues which are sprung together and entered in an opening in gear 11 whereby their tendency to spring apart holds them firmly in engagement with the walls of said opening. Arm 13 terminates in a pointer 14 for cooperation with a wave scale 15 suitably inscribed adjacent to gear 11, while an index 16 on a part of eccentric 12 is designed for cooperation with an index 17 on arm 13 in a manner and for a purpose which will appear hereinafter.

As is understood, the foregoing arrangement constitutes only a preferred means whereby the rotor shaft of one of the tuning units may be rotated individually, since it is obvious that if means other than a rack is employed for operating the units collectively, the rods of my application 98,558, for example, gear 10 would be replaced by a disk or an arm, and if desired, the eccentric arrangement of my application 683,756 or some other similar arrangement might readily be substituted for the eccentric arrangement herein shown, irrespective of the form of collective operator employed.

The units other than the one just described preferably, but not necessarily, are of duplicate construction, each including a variable speed mechanism as shown, so that a description of one will suffice for all. On its rotor shaft *a* is mounted loosely, for rotation with respect to said shaft, a gear 18, while affixed to said shaft is an arm 19. A lateral extension 20 on gear 18 pivotally supports a pair of arms 21 and 22 which are disposed preferably at right angles and rigid with respect to one another and which, respectively, engage arm 19 and an adjustable control member 23, so that when gear 18 is rotated at a constant velocity, shaft *a* will be rotated either at the same or at a variable velocity according to the adjustment of member 23, it being noted that since arms 21 and 22 are rigid with respect to one another and are connected with arm 19 and member 23, respectively, a reactance is secured from member 23 to rotate shaft *a* through arm 19 when gear 18 is rotated.

Member 23 in the present instance is in the form of an inherently rigid ring having its inner edge beveled for engagement with the threads of three screws 24, 25 and 26, which screws are rotatably mounted in individual recesses 27 formed at circumferentially spaced intervals in the outer face of a relatively wide, circularly-shaped member 28, which member is secured to any suitable fixed support such as a panel board 29, heads on said screws being positioned between said panel board and an adjacent face of said member 28 whereby said screws are prevented from moving longitudinally when they are rotated, the result being that by rotatably adjusting said screws, ring 23 may be moved either bodily in the direction of the axis of shaft *a* inwardly or outwardly with respect to gear 18 to produce rotation of shaft *a* independently of movement of gear 18, or tilted in any bodily moved position thereof

along said shaft about a line 30, see Fig. 6, drawn between its points of contact with any two of the screws to lie in different planes transverse with respect to said shaft to cause shaft *a* to be rotated at variable velocities during rotation of gear 18 at a constant velocity.

Member 23 is mounted concentrically with respect to shaft *a* whereby arm 22, which has a bifurcated free end engaging said member will follow same during rotation of gear 18, and in order that the ratio of leverage between arms 91 and 21 may be varied, arm 21 preferably enters an elongated slot 31 in arm 19 and is bendable towards and away from shaft *a*, it being obvious that by bending arm 21 towards said shaft the effective length of lever arm 19 will be shortened to speed up rotation of shaft *a* for a given movement of arm 21, and that by bending said arm away from said shaft the effective length of lever arm 19 will be increased to slow up rotation of shaft *a* for a given movement of arm 21.

Member 21 furthermore preferably is mounted out of sight behind gear 18, and arm 21 extends through a slot 32 in said gear into engagement with arm 19 which arm preferably is mounted on shaft *a* at the front of gear 18, said slot further serving as a means whereby access may be had to the screws 24, 25 and 26 for rotatably adjusting them. Preferably, too, said screws are formed with double threads to produce maximum movements of member 23 by relatively slight amounts of rotation of said screws, and in addition arm 19 preferably is formed of resilient material whereby it may be sprung out of engagement with arm 21 to permit free rotation of shaft *a* at any time to test the accuracy of adjustment of member 23.

Rack bar 10 engages the gears 11 and 18 of all units for operating them collectively, same being supported on yieldably mounted rollers 33 as in my application 689,338.

Now, in order initially to pretune the apparatus by means of the mechanism constituting my invention so that thereafter all units will tune simultaneously with different wave lengths encountered during collective operation of the units, the procedure is as follows: First, the unit that is provided only with the eccentric vernier adjustment previously described is brought approximately in tune with some wave length encountered when the bifurcated ends of arms 22 of the other units are disposed in the vicinity of corresponding screws 24, 25 or 26 of their respective control members 23. Eccentric 12 then is rotated first in one direction and then in the other direction and at the same time rack bar 10 is moved as required to place the unit first mentioned accurately in tune with that wave length when the indices 16 and 17 are in registry with one another. Next, assuming that the unit last mentioned has been tuned accurately in the manner described with a wave length encounter when the bifurcated ends of arms 22 of the other units are disposed for example in the vicinity of corresponding screws 25 of their respective control members 23, said screws are adjusted successively to tilt their associated control members about the other two screws thereof and thus move their associated lever arms 22, 21 and 19 to rotate shafts *a* and bring the other units successively into accurate tune with the same wave length, rack bar 10 being immovable during this operation. All of the units at this time having been pretuned accurately to one wave length, that is, adjustments having been made to the mechanisms associated with the different units, so that if rack bar 10 is moved to another position and then returned to its original position all units will again tune accurately with the wave length encountered at its original position, the next operation is to move the movable parts of the units collectively by means of rack bar 10 until another wave length is encountered when the bifurcated ends of arms 22 are disposed in the vicinity either of corresponding screws 24 or 26. When this has been done, the unit equipped with eccentric 12 is adjusted in the manner previously described, by rotating said eccentric first in one direction and then in the other and at the same time moving rack bar 10 slightly as necessary, until same tunes accurately with this second wave length when the indices 16 and 17 are in registry with one another. Next, assuming that the bifurcated ends of arms 22 of the other units are disposed in the vicinity of the screws 24 of their respective control members 23 when the unit having the eccentric 12 has been adjusted to tune accurately with said second wave length, said screws 24 are adjusted successively to tilt their associated control members about the other two screws thereof and thus move their associated lever arms 22, 21 and 19 to rotate shafts *a* and bring the other units successively into accurate tune with said second wave length, rack bar 10 as before being immovable during this latter operation. All of the units at this time obviously have been pretuned accurately to two wave lengths, since the adjustments of members 23 first made by screws 25 are unaffected to any material extent by adjustments of screws 24. Furthermore, although eccentric 12 was moved during tuning of the unit that is equipped therewith, said eccentric was restored to its original position with indices 16 and 17 in registry with one another before any adjustments were made to screws 24, so that the pretuned relation of said unit with the first wave length was destroyed only during pretuning of said unit with the second wave length and was restored before the other units were pretuned with the second wave length, it being pointed

out in this connection that eccentric 12 is provided merely to facilitate accurate pretuning of the unit that is equipped with same and once this unit has been pretuned with wave lengths encountered when the bifurcated ends of the arms 22 of the other units are in the vicinity of each of the screws 24, 25 and 26 of their respective control members no further movements of eccentric 12 are necessary or desirable, the indices 16, 17 providing means whereby eccentric 12 may be restored to a normal position after it has been utilized to facilitate accurate tuning of its associated unit with a different wave length.

The next operation is to move the movable parts of the units collectively by means of rack bar 10 until a third wave length is encountered when the bifurcated ends of arms 22 are disposed in the vicinity of the remaining screws 26 of their associated control members 23. When this has been done the unit equipped with eccentric 12 is adjusted as before to bring said unit accurately in tune with the third wave length and the screws 26 of the other units are adjusted successively in the manner of screws 25, 24 to tilt the control members 23 and thus bring the other units accurately in tune with the third wave length.

When control members 23 have been adjusted at three spaced points to cause the tuning units to be pretuned accurately with three widely separated wave lengths, a low, an intermediate and a high wave length for example, said units obviously will be pretuned substantially with all wave lengths encountered between the three wave lengths with which they are accurately pretuned due to the inherent rigidity and symmetrical shape of control members 23 and to the effective portion of the latter being disposed between the adjusting screws which are not distantly spaced apart. The result is that by means of my present mechanism, which is simple, cheap and easy to produce, a radio apparatus may be pretuned for all wave lengths sufficiently accurately to meet all commercial requirements without the necessity of bending or otherwise deforming any part of the mechanism and by a few easily effected adjustments.

In Figs. 8 and 9 of the drawings I have illustrated a modification of my invention in which the tiltable control members are in the form of toothed plates which are rotatable with the movable parts of the tuning units which they control and which cooperate with a spiral gear carried by the movable part of another of the units whereby the movable parts of all units are connected together for collective operation without the employment of a rack bar or similar common operator with its necessary appendages as in the arrangement shown in Figures 1 to 7, and whereby movement of the movable parts of the units at variable velocities may be effected during rotation of said spiral gear at a constant velocity without the employment of a lever mechanism such as is illustrated in Figures 1 to 7. In other words the modified structure of Figures 8 and 9 may be said to be a combination of certain novel structural features illustrated in my prior aplications 89,442 and 95,138 with my present improvements incorporated therein.

Specifically, the structural arrangement of Figures 8 and 9 is as follows: On the rotor shaft a' of one of the tuning units is mounted loosely for rotation with respect to said shaft a spiral gear 34, while affixed to said shaft is an arm 35 having a slot 36 therein within which operates an eccentric 37 carried by said gear, suitable friction means such as a spring washer 38 being associated with said eccentric to hold same in any rotatably adjusted position. Also, affixed to said shaft as a means whereby same may be rotated conveniently is a knob 39, and in addition a pointer or index 40 is provided on arm 35 for cooperation with a companion pointer or index 41 provided on gear 34. As a result of this arrangement if gear 34 is held against rotation and eccentric 37 is rotated, said eccentric will react from said gear through arm 35 to rotate shaft a', while on the other hand, if gear 34 is rotated, shaft a' will be rotated therewith due to the interlock between said gear and shaft provided by eccentric 37 and arm 35.

On the rotor shaft a' of each of the other units is mounted a spider member 42 and a lever arm 43, the spider members being loose on their respective shafts for rotation with respect thereto and the lever arms 43 being affixed to said shafts, respectively. Each spider member includes three radial arms 44, 45 and 46 having threaded therein, respectively, screws 47, 48 and 49, the set of screws carried by each spider member having swivel connections at three spaced, disalined points with a segmentally-shaped plate 50 having peripheral teeth in mesh with the spiral teeth of gear 34. One of the arms of each spider member 42 carries an eccentric 51 which operates in a slot 52 in its associated lever arm 43 as and for the purpose of eccentric 12 of Figures 1 to 7 or eccentric 37 just described. Plates 50 are inherently rigid and are tiltable by adjusting screws 47, 48 and 49 exactly in the same manner as control members 28 of Figures 1 to 7, and the manner of pretuning an apparatus equipped with the mechanism of Figures 8 and 9 is the same as that set forth in connection with the disclosure of Figures 1 to 7, the principal difference between the two arrangements being that the spiral teeth of gear 34 cooperate with the tiltable toothed plates 50 in a manner set forth in detail in my application 89,442

to produce the necessary variable movement between the units to cause them to tune simultaneously with different wave lengths encountered during their collective operation.

In Figures 10 to 13 of the drawings I have illustrated my present improvements as embodied in a tuning unit of the type disclosed in my prior application 89,443, that is as embodied in a tuning unit in the form of a variable plate condenser in which the movable plates are capable of variable movement in one direction while they are being moved at a constant rate of speed in another direction. As illustrated in Figures 10 to 13 such a condenser includes a set of stator plates *c* and a set of movable plates *d* adapted for movement into different overlapping relations with respect to plates *c*. The stator plates *c* are mounted on a block 53 which is adapted to be secured to any suitable support, and said block has rotatably mounted therein a shaft 54 having a pair of spaced arms 55 extending therefrom between which the plates *d* are mounted by means of a pivot pin 56 for swinging or pivotal movements with respect to said arms. One of the arms 55 is provided with an extension 57 which reaches to a point in proximity to the free ends of the plates *d*, and a forked member 58, rigid with respect to plates *d* at their free ends, engages a reduced portion 59 of the extension 57 whereby said plates *d* are held against lateral deflection such as might otherwise occur and interfere with proper interdigitating movements of said plates *d* with respect to plates *c*. In other words, forked member 58 and extension 57 provide a support at the free end portions of the plates *d* which will hold such plates against lateral movement at their free ends, but which will permit said plates to pivot or swing about pin 56.

The free end of extension 57 terminates in a pin 60 on which is mounted a bell-crank lever 61 including a pair of arms 62 and 63 the former of which is bifurcated or slotted as at 64 to receive a pin 65 carried by plates *d* at their free ends, and the latter of which is provided with a spherical extremity 66 which is disposed in a channel or groove 67 in an inherently rigid, tiltably adjustable control member 68, which latter is curved and mounted concentric with respect to the axis of shaft 54 on three spaced screws 69, 70 and 71 threaded in a suitable support such as a panel board 72 and having swivel connections with said control member. Control member 68 is tiltably adjustable by screws 69, 70, 71 in the same manner as control members 28 of Figures 1 to 7 and as plates 50 of Figures 8 and 9, so that when shaft 54 is rotated at a constant velocity the plates *d* not only will be moved into different overlapping relations with respect to plates *c* in one direction, but due to the bell-crank lever 61 and control member 68, said plates *d* will be caused to partake of variable movement—swinging or pivotal movement about pin 56—during rotation of shaft 54 according to the tiltably adjusted position of said control member. In other words, the structure illustrated provides means whereby the area of overlap between the plates *c* and *d* may be varied for any given angular movement of shaft 54, without bending or otherwise deforming any part of the mechanism.

Obviously as many condensers as desired of the type shown in Figures 10 to 13 may be connected together for collective operation.

In the modified form of my invention shown in Fig. 14 I have illustrated another arrangement by which a lever mechanism such as has been described hereinbefore may be associated with a control member which is tiltable or otherwise adjustable so as to produce movement of the movable part of a tuning unit at variable velocities during movement of an operator at a constant velocity. In this form of my invention the shaft a^2 of the tuning unit, which shaft is understood to carry movable condenser plates or their equivalent, has mounted thereon a gear 73 and a lever arm 74, gear 73 being loose on said shaft for rotation with respect thereto and lever arm 74 being affixed to said shaft. To gear 73 or to a member 75 which is secured rigidly to said gear is pivoted a bell-crank lever 76 including a pair of arms 77, 78 one of which carries at its free end a pin 79 engaging a slot 80 in lever arm 74 and the other of which is connected at its free end with a control member 81, the result being that as gear 73 is rotated at a constant velocity shaft a^2 will be caused to rotate either at a constant or at variable velocities according to the adjustment of control member 81, as it is from this control member that bell-crank lever 76 reacts during rotation of gear 73 to impart movement to shaft a^2 through lever arm 74. Control member 81 is mounted on screws 82 and in this instance it is flexible and adapted to be bent into irregular shape by proper adjustments of said screws. Obviously, however, it might be inherently rigid and supported for tilting movement only as in the forms of my invention previously described.

In Figure 15 of the drawings I have illustrated a further modification of my invention to show that an operating arrangement such as is disclosed in my application 690,795 may have associated therewith a bell-crank lever mechanism and a control member as disclosed herein to cause the movable part of a tuning unit to be moved at variable velocities during movement of an operator at a constant velocity. In this form of my invention a gear 83, understood to be fixed to the shaft of the movable part of a tuning unit, is engaged by a rack bar 84 longitudinally movable with respect to a rod 85 which is understood to lead to other units and to

constitute a common operator for a plurality of units as in my aforesaid application 690,795. A bell-crank lever 86 is pivoted to rod 85 and one arm of said bell-crank is connected with rack bar 84 while the other arm thereof is operatively engaged with an adjustable control member 87, the result being that as rod 85 is shifted variable rotation is imparted to gear 83 according to the adjustment of control member 87 due to the fact that the bell-crank reacts from said control member to shift the rack bar during shifting of said rod 85.

From the foregoing description considered in connection with the accompanying drawings it is believed that the construction, operation and advantages of my present improvements will be fully understood. I desire to point out, however, that various changes and desirable additions may be made in and to the different structural arrangements shown within the spirit and scope of my invention as defined in the appended claims.

I claim:

1. In radio apparatus, a tuning unit a part of which is rotatable, a shaft carrying said rotatable part, a member loose on said shaft, an operator for rotating said member, and mechanism for transmitting rotary movement of said member to said shaft, said mechanism including a member fixed to said shaft, a tiltably adjustable control member concentric with said shaft, and means carried by the member that is loose on said shaft operatively connected with said control member and with the member that is fixed to said shaft, whereby the same movement of said operator at a constant velocity may be caused to produce rotation of said shaft at different variable velocities according to the tiltably adjusted position of said control member.

2. In radio apparatus, a tuning unit a part of which is rotatable, a shaft carrying said rotatable part, a member loose on said shaft, an operator for rotating said member, and mechanism for transmitting rotary movement of said member to said shaft, said mechanism including a member fixed to said shaft, a control member concentric with said shaft and adustable to lie in different planes transverse with respect to said shaft, and means carried by the member that is loose on said shaft connecting the member that is fixed to said shaft with said control member and reacting from the latter to produce rotation of said shaft at variable velocities during rotation of the member that is loose on said shaft at a constant velocity.

3. In radio apparatus, a tuning unit a part of which is rotatable, a shaft carrying said rotatable part, a member loose on said shaft, an operator for rotating said member, mechanism for transmitting rotary movement of said member to said shaft, said mechanism including a member fixed to said shaft, a control member concentric with said shaft and adjustable to lie in different planes angular with respect to the plane of said loose member, and a pair of lever arms disposed at an angle to one another, rigidly connected together and pivoted to said loose member, one of said lever arms being operatively connected with the member that is fixed to said shaft and the other being operatively connected with said control member whereby rotation of said loose member is transmitted to said shaft either at constant or variable velocities during rotation of said loose member at a constant velocity, according to the adjustment of said control member.

4. In radio apparatus, a tuning unit a part of which is movable, an operator for said movable part, and means to cause said movable part to move at variable velocities during movement of said operator at a constant velocity, said means including a control member and a bell crank lever one of the arms of which is operatively engaged with said control member and the other arm of which is operatively connected with said movable part, said bell crank lever being carried by said operator whereby it is caused to react from said control member to move said movable part during movement of said operator.

5. In radio apparatus, an adjustable tuning unit, a rotatable operator, a control member, means supporting said control member for tiltable adjustment about a plurality of axes at angles to one another to a position in a plane at an angle to the plane of rotation of said operator, and means cooperating with said control member establishing a driving connection between said operator and said unit effective to produce adjusting movement of said unit at variable velocities during movement of said operator at a constant velocity.

6. In radio apparatus, an adjustable tuning unit, an operator, a control member, means supporting said control member for tiltable adjustment about a plurality of axes at angles to one another, and means cooperating with said control member establishing a driving connection between said operator and said unit effective to produce adjusting movement of said unit at variable velocities during movement of said operator at a constant velocity.

7. In radio apparatus, an adjustable tuning unit, an operator, a control member, adjustable means supporting said control member at three spaced points disposed out of a straight line whereby it is tiltably adjustable about any two of its points of support by manipulation of the supporting means at its third point of support, and means cooperating with said control member establishing a driving connection between said operator and said unit effective to produce adjusting move-

ment of said unit at variable velocities during movement of said operator at a constant velocity.

8. In radio apparatus, an adjustable tuning unit, a rotatable operator, a control member concentric with respect to the axis of rotation of said operator, means supporting said control member for tiltable adjustment about a plurality of axes at angles to one another to a position in a plane at an angle to the plane of rotation of said operator, and means cooperating with said control member establishing a driving connection between said operator and said unit effective to produce adjusting movement of said unit at variable velocities during movement of said operator at a constant velocity.

9. In radio apparatus, an adjustable tuning unit, an operator, a control member, means for adjustably supporting said control member consisting of a plurality of screws in threaded engagement with said control member, means mounting said screws for rotation and holding them against longitudinal movement, and means cooperating with said control member establishing a driving connection between said operator and said unit effective to produce adjusting movement of said unit at variable velocities during movement of said operator at a constant velocity.

10. In a radio apparatus, an adjustable tuning unit, an operator, a control member in the form of a ring having a beveled edge, means for adjustably supporting said ring consisting of a plurality of screws in threaded engagement with the beveled edge thereof, means mounting said screws for rotation and holding them against longitudinal movement, and means cooperating with said ring establishing a driving connection between said operator and said unit effective to produce adjusting movement of said unit at variable velocities during movement of said operator at a constant velocity.

In testimony whereof I hereunto affix my signature.

DORSEY F. ASBURY.