March 8, 1938. H. E. BROHMAN 2,110,196

TUNING SYSTEM FOR RADIO RECEIVERS

Filed Sept. 6, 1935 3 Sheets-Sheet 1

Fig. 1

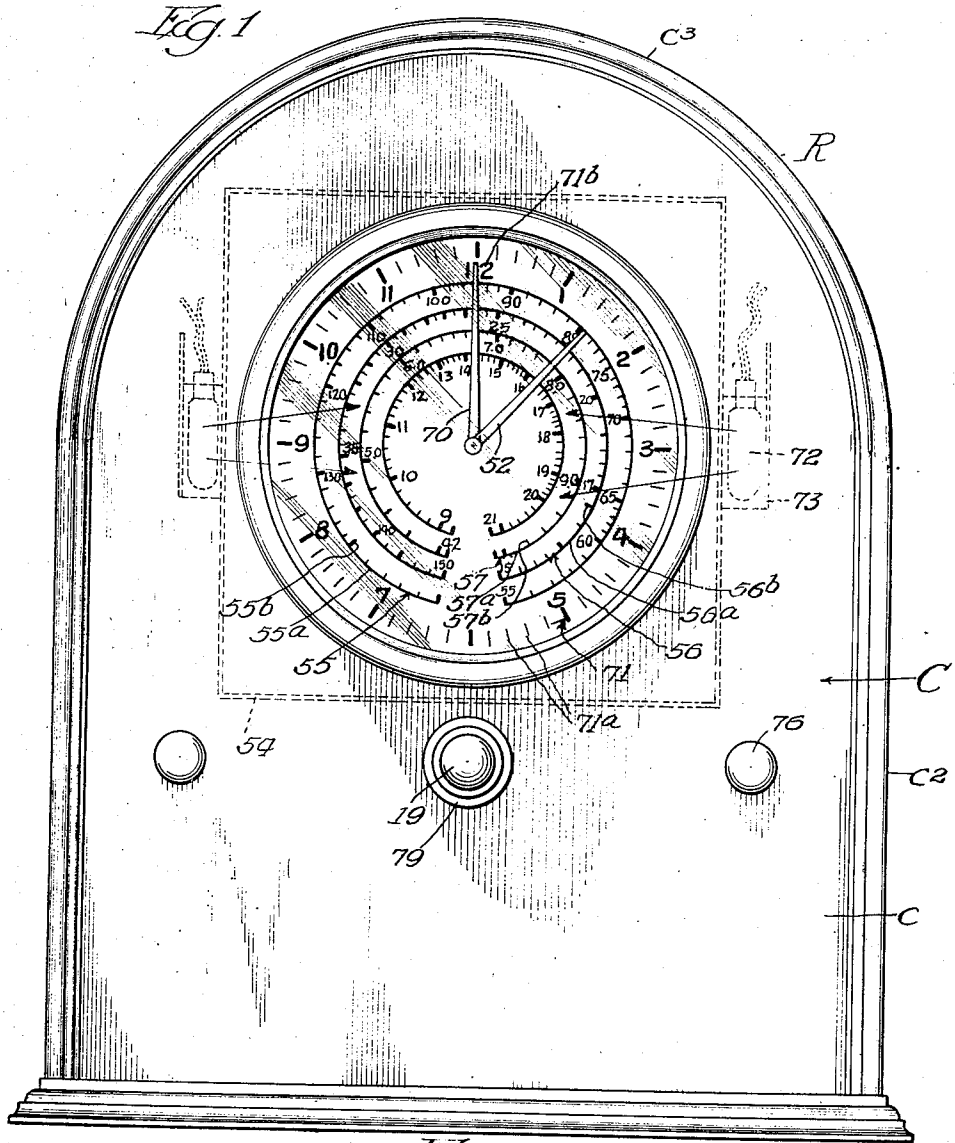
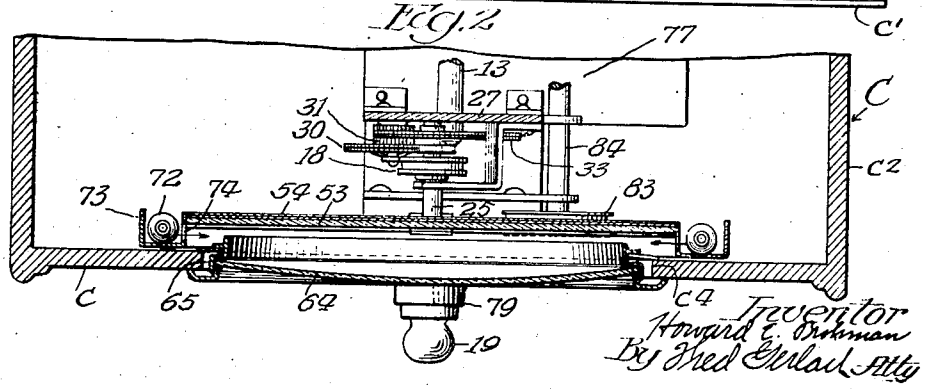


Fig. 2



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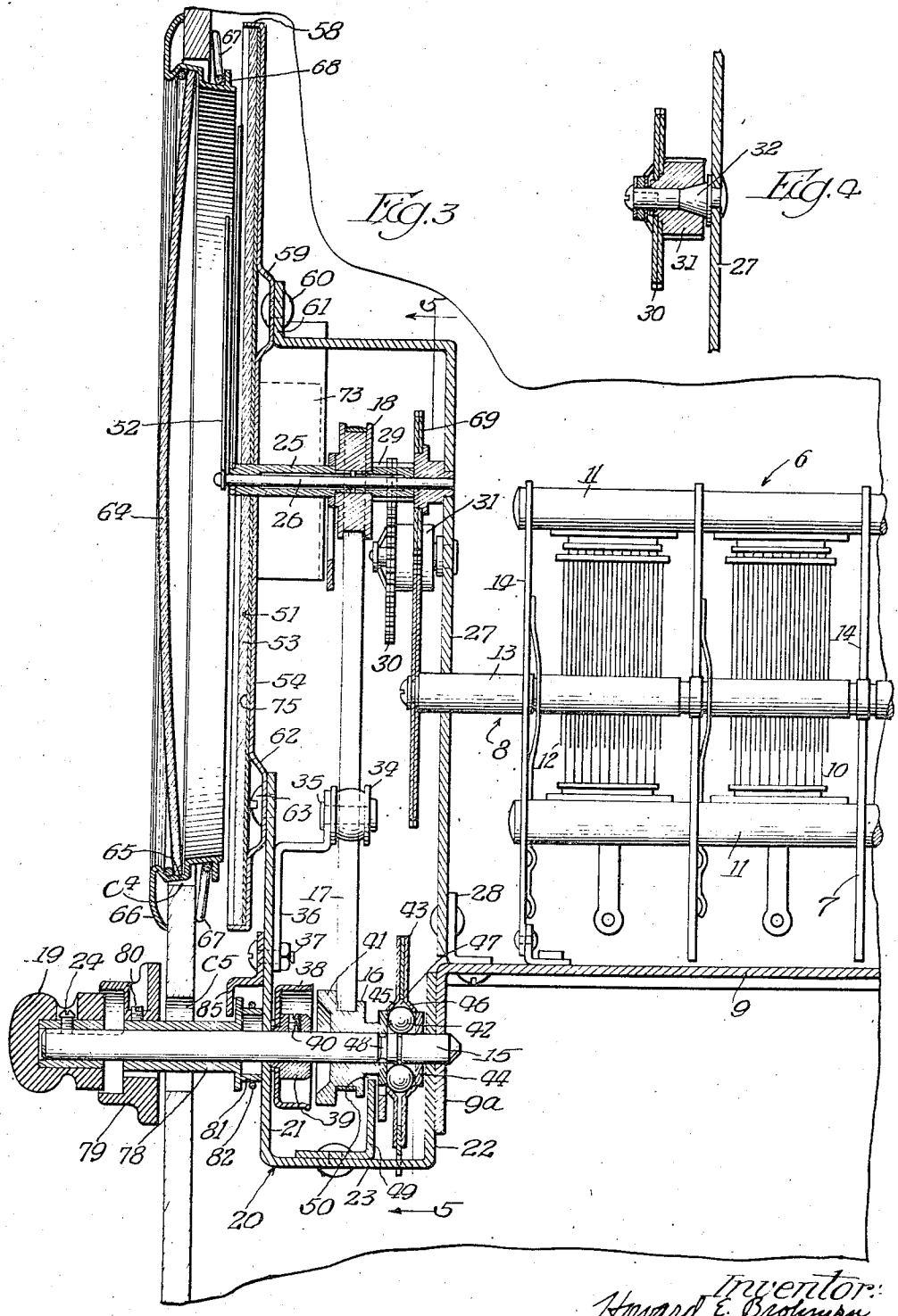


Fig. 3

Fig. 4

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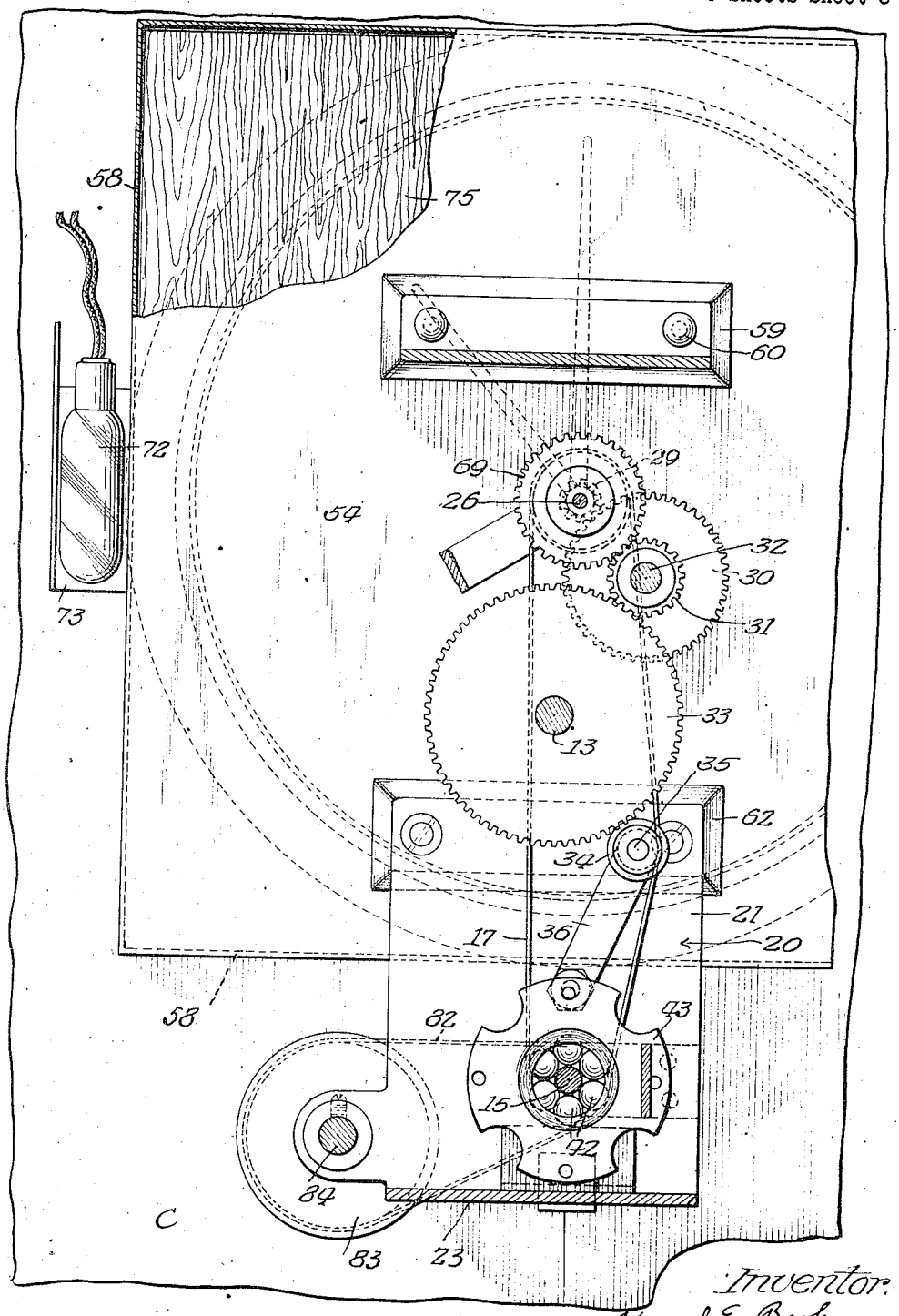


Fig. 5

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UNITED STATES PATENT OFFICE

2,110,196

TUNING SYSTEM FOR RADIO RECEIVERS

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Application September 6, 1935, Serial No. 39,391

7 Claims. (Cl. 74—10)

The present invention relates generally to tuning systems for radio receivers. More particularly the invention relates to that type of tuning system which is designed for use with a cabinet-housed radio receiver having a variable condenser and a range switch, and comprises: (1) a knob-equipped shaft and driving mechanism between the shaft and the rotor of the condenser for use in manually turning and adjusting the rotor in connection with tuning of the radio receiver and, (2) a dial and pointer for indicating the setting of the condenser.

One object of the invention is to provide a tuning system of this type which is an improvement upon previously designed systems of the same general character by reason of the fact that it includes a high speed drive between the knob-equipped shaft and the driving mechanism whereby the mechanism may be driven by the shaft in a speedy or quick manner for quick adjustment or setting of the rotor of the condenser, and also includes a low speed drive between the shaft and the mechanism whereby a minute setting or adjustment of the condenser may be obtained.

Another object of the invention is to provide a tuning system of the last mentioned character in which the knob-equipped shaft is mounted for longitudinal slidable movement as well as rotation, and the high speed drive between the shaft and the driving mechanism is brought into play when the shaft is shifted in one direction and the low speed drive is brought into play when the shaft is shifted in the opposite direction.

Another object of the invention is to provide a radio tuning system of the type and character under consideration in which the driving mechanism between the knob-equipped shaft and the rotor of the condenser comprises a pulley system in the form of a drive pulley and a driven pulley and also comprises speed reducing gearing between the driven pulley and the shaft which supports rotatably and forms a part of the condenser rotor.

Another object of the invention is to provide a tuning system in which the dial has substantially circular, concentrically arranged wave bands which are calibrated in kilocycles, and the pointer is connected to the driving mechanism between the knob-equipped shaft and the rotor of the condenser so that it swings throughout an arc of approximately 340° when the condenser rotor is shifted from a position wherein the plates thereof are in completely overlapped relation with respect to the plates of the condenser stator into a position wherein the plates are out of registry or lapped relation with respect to the stator plates.

A further object of the invention is to provide a tuning system of the type and character under consideration which includes in addition to the regular tuning pointer a vernier pointer which is adapted to rotate completely around the dial and indicates fractional positions of the main pointer with respect to kilocycle calibrations on the wave bands or scales.

An additional object of the invention is to provide a tuning system which is generally of new and improved construction and includes a novel dial arrangement and means for illuminating the dial.

Other objects of the invention and the various advantages and characteristics of the present tuning system will be apparent to those skilled in the art from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of the present specification or disclosure and in which like letters and numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a front view of a radio receiver having a tuning system embodying the invention;

Figure 2 is a plan view showing the arrangement of the gear train and other details of construction;

Figure 3 is a vertical section showing in detail the construction and arrangement of the various parts which comprise the system;

Figure 4 is a sectional view of certain of the gears of the gear train between the driven pulley and the rotor of the condenser; and

Figure 5 is a section on the line 5—5 of Figure 3.

The tuning system which forms the subject matter of the invention is designed for use in connection with a radio receiver R of conventional or standard type. As shown in Figure 1 of the drawings, this receiver comprises a cabinet C for housing the various operating parts thereof. The cabinet is adapted to be placed upon a table or any other support as well understood in the art, and includes a front wall c, a base c^1, sides c^2 and a top c^3. The front wall is suitably secured to the front margin of the base c^1, and the upper portion thereof is semicircular and has

a large circular aperture c^4. The sides c^2 are secured to the side edges or margins of the front wall c, and together with the front wall, base and top of the cabinet form a compartment or chamber for the operating parts of the radio receiver. The top c^3 is curved in conformity with the top portion of the front wall and the ends thereof join and form continuations of the upper ends of the sides c^2.

The operating parts of the radio receiver include a variable condenser 6. The latter operates as the tuning medium for the receiver and consists of a stator 7 and a rotor 8. As shown in Figure 3 of the drawings the stator is mounted on a bracket 9 and consists of a series of equidistantly spaced, metallic plates 10. These plates are fixedly secured to a pair of conductors 11 which are arranged in parallel relation and together with a plurality of vertically extending plates 14 form a frame for the condenser. The rotor 8 is supported by the frame and consists of a shaft 13 and a plurality of equidistantly spaced, metallic plates 12. The shaft 13 is journalled in the plates 14 of the condenser frame and is adapted to be rotated as hereinafter described for tuning purposes. The plates 12 are fixedly secured to the central portion of the shaft 13 and are adapted in response to rotation of the shaft 13 to be swung into and out of interleaved relation with the plates 10 of the stator. By swinging the plates 12 into and out of interleaved or lapped relation with respect to plates of the stator, the capacity of the radio receiver may be changed and different radio broadcasting stations obtained as well as understood in the art. The bracket 9 is suitably supported above the base c^1 of the cabinet C and supports the condenser 6 so that the shaft 13 of the stator extends at right angles to the front wall c and is positioned behind the aperture c^4.

The tuning system includes as a part thereof novel and improved mechanism for rotating or tuning the rotor of the condenser. This mechanism comprises a horizontally extending shaft 15, a pulley or drive element 16, a belt 17, a pulley 18 and a gear train between the pulley 18 and the shaft 13 of the condenser rotor. The shaft 15 is disposed directly beneath the aperture c^4 and extends through a hole c^5 in the front wall c of the cabinet C. It is provided at its outer or front end with a knob 19 and is carried by a U-shaped bracket 20 so that it is rotatable and also slidable longitudinally. The bracket 20 comprises a pair of upstanding legs 21 and 22 and a horizontally extending connecting part 23. The leg 22 fits against and is connected to a depending leg 9^a on the front end of the bracket 9. The legs of the bracket 20 have aligned holes through which the shaft 15 extends. The knob 19 has a socket for receiving the extreme outer end of the shaft 15 and has a setscrew 24 whereby it is fixedly secured to the shaft. The pulley 16 is loosely mounted on the shaft 15 and is disposed between the upstanding legs 21 and 22 of the bracket 20. The belt 17 extends around, and forms a driving connection between, the pulleys 16 and 18. As shown in Figure 3, the pulley 18 is fixedly secured to a sleeve 25 which is loosely mounted on a shaft 26. The latter is supported at its inner end by a plate 27 which extends parallel to and is disposed behind the front wall c of the cabinet C and is connected at its lower end by an angle bracket 28 to the front end of the bracket 9. The gear train between the pulley 18 and the shaft 13 of the rotor 8 of the condenser consists of a pinion 29 which is formed as an integral part of the inner end of the sleeve 25 and is disposed directly behind the pulley 18; a gear 30 which meshes with and is driven by the pinion 29 and is located beneath and at one side of the sleeve 25; a pinion 31 which is fixed to rotate with and forms the hub of the gear 30 and is mounted on a pin or stud 32 on the plate 27; and a gear 33 which meshes with and is driven by the pinion 31 and is fixedly secured to the front end of the rotor shaft 13. When the pulley 16 is rotated in one direction the belt 17, the pulley 18 and the gear train between the last mentioned pulley and the rotor shaft 13 operate to swing the rotor in one direction with respect to the stator. Reverse rotation of the pulley 16 operates to effect reverse rotation or swinging of the rotor. A flanged roller 34 serves to keep the belt 17 taut in order to maintain at all times a driving connection between the pulleys 16 and 18. This roller is mounted on a pin 35 which is secured to and projects rearwardly from the distal end of an arm 36 which is pivotally mounted on and extends upwardly from a bolt 37 on the leg 21 of the U-shaped bracket 20. The arm 36 extends angularly with respect to the vertical and as a result its weight together with that of the roller operates to urge the roller outwardly with respect to one of the reaches of the belt and thus to tighten the belt. An advantage of employing the gear train between the pulley 18 and the shaft 13 of the rotor is that the tension of the belt resulting from the operation of the roller or belt tightener 34 is not transmitted to the shaft 13 of the rotor and the rotor is thus not likely to be thrown out of alignment with respect to the stator of the condenser.

The shaft 15 is adapted to drive the pulley 16 through a direct or high speed drive and also through an indirect or low speed drive.

The high speed drive comprises a cup-shaped clutch member 38 which has a hub 39 and is disposed between the pulley 16 and the leg 21 of the U-shaped bracket 20. The hub as shown in Figure 3 of the drawings is mounted on the shaft 15 and is fixed to the latter by means of a setscrew 40, so that it together with the clutch member, is secured to rotate with the shaft in response to turning of the knob 19. The clutch member 38 is adapted when the shaft 15 is shifted rearwards to slide over and engage a circular clutch member 41 on the front end of the pulley 16. When the cup-shaped clutch member engages the member 41 the pulley 16 is secured to the shaft 15 so that it is rotatable therewith. Thus when the shaft 15 is shifted rearwards so as to bring the cup-shaped member 38 into engagement or gripping relation with the circular clutch member 41, a direct drive is established between the shaft 15 and the pulley 16 whereby the pulley may be rotated in either direction by manipulation of the knob 19. When the shaft 15 is shifted outwards by pulling on the knob 19, the cup-shaped clutch member 38 is brought out of engagement or gripping relation with the clutch member 41 and the direct or high speed driving mechanism between the shaft 15 and the pulley 16 is broken.

The indirect or low speed drive between the shaft 15 and the pulley 16 consists of an annular series of balls 42 around the shaft 15 and a ring-shaped element 43 around the balls. The balls 42 are confined between, and engage the inner faces of, the rear end of the pulley 16 and a

disk 44 on the rear end of the shaft 15. The ring-shaped element 43 is formed of three pieces of sheet metal. The inner or intermediate piece serves as a spacer for the outer pieces and is secured to the horizontally disposed connecting part 23 of the U-shaped bracket 20 in such manner that the element 43 is fixedly or rigidly secured in place. The front sheet metal piece of the ring-shaped element is fixed to the intermediate piece and embodies at the inner margin thereof a forwardly extending flange 45. The rear sheet metal piece of the ring-shaped element 43 is the same in size and shape as the front piece and has a rearwardly extending flange 46. The flanges 45 and 46 form a V-shaped groove 47 therebetween in which the balls 42 are adapted to travel. The shaft 15 is provided with an annular groove 48 at its rear end. This groove is located or positioned on the shaft so that it receives the balls 42 when the shaft is shifted rearwardly so as to engage the cup-shaped clutch member 38 and connect the pulley for direct or high speed drive from the shaft. When the balls 42 are in the groove 48 they are loose with respect to the flanges 45 and 46. When the shaft 15 is shifted outwards so as to disconnect the direct or high speed drive between the shaft and the pulley 16, the balls 42 are moved outwards into engagement with the flanges 45 and 46. As a result of this when the shaft 15 is rotated, the balls are caused to travel slowly around the flanges and because of their contact with the inner end of the pulley 16 cause the pulley to revolve or rotate therewith. Since the balls travel around the flanges more slowly than the shaft rotates, the pulley 16 turns at a reduced or slower speed with respect to the shaft. When the shaft is shifted rearwards so as to connect the pulley for direct or high speed drive by the shaft, the balls seat in the groove 48 and since they are not urged outwardly into contact with the flanges they do not revolve or travel around the ring-shaped element 43 in response to rotation of the shaft. The pulley 16 is held against axial displacement relatively to the bracket 20 by means of an L-shaped bracket 49. This bracket is secured to the connecting part 23 of the bracket 20 and is arranged so that one leg thereof projects into an annular groove 50 in the rear end of the pulley 16.

In addition to the mechanism for turning or rotating the stator of the condenser, the tuning system comprises a dial 51 and a main pointer 52. These two elements or parts of the tuning system serve as an instrumentality for showing the setting of the condenser and permitting the user of the radio receiver R to locate different broadcasting stations. The dial 51 is located directly behind the aperture c^4 in the upper portion of the front wall c of the cabinet C, and comprises a square glass plate 53. This plate is mounted in a sheet metal frame 54 and has a high wave length band 55, an intermediate wave length band 56 and a low wave length band 57. The frame 54 is square and has a forwardly extending marginal flange 58 which surrounds the edges of the glass plate 53 and serves to hold the glass plate in place. The upper portion of the frame is deflected or stamped rearwardly to form a boss 59 which is secured by a stud 60 to an ear 61 on the upper end of the plate 27. The lower portion of the frame 54 is struck or deflected rearwardly so as to form a boss 62 directly beneath the boss 59. This boss 62 is connected by a stud 63 to the upper end of the leg 21 of the U-shaped bracket 20. By connecting the boss 59 to the plate 27 and the boss 62 to the U-shaped bracket, the frame together with the glass plate 53 is secured fixedly in place and is held at a small distance behind the portion of the front wall c which defines the aperture c^4. The dial 51 is covered or protected by a glass disk 64. This disk is mounted in a sheet metal ring 65 which fits within the aperture c^4 and has an outwardly extending circular flange 66 at the front margin thereof. This flange, as shown in Figure 3 of the drawings, covers the aperture c^4 and engages the front face of the front wall c of the cabinet. The ring 65 is held in place by means of a spring wire member 67 which surrounds the rear portion of the ring and extends between the rear face of the front wall c of the cabinet and an outwardly extending flange 68 on the rear end of the ring. The high wave length band 55 consists of a 340° arc 55^a and kilocycle calibrations 55^b extending radially inwards from the arc. The intermediate wave length band 56 consists of a 340° arc 56^a and an annular series of kilocycle calibrations 56^b which extend radially inwards from the arc 56^a. This arc 56^a is smaller than and is concentrically arranged with respect to the arc 55^a of the high wave length band 55. The low wave length band 57 consists of a 340° arc 57^a and an annular series of kilocycle calibrations or graduations which extend radially inwards from the arc 57^a. The latter arc as shown in Figure 1 of the drawings, is smaller than the arc 56^a of the band 56 and is concentrically arranged relatively to the latter. The main pointer 52 is disposed in front of the glass plate 53 and is fixed to and radiates from the outer or front end of the shaft 26. The shaft extends through the center of the glass plate and is driven from the pinion 31 by means of a gear 69. This gear meshes with said pinion 31 and is fixed to the inner or rear end of the shaft 26. When the rotor 8 of the condenser is turned or rotated by manipulation of the knob 19, the shaft 26 rotates and in turn swings the pointer 52 over the bands 55, 56 and 57. The gear 69 is of such size that the pointer travels throughout an arc of 340° when the condenser rotor is rotated from a position wherein the plates 14 thereof are in complete overlapped relation with respect to the plates of the condenser stator into a position wherein the rotor plates are out of overlapped relation with respect to the stator plates. By having the pointer rotate throughout an arc of 340° the kilocycle calibrations of the wave length bands may be spaced sufficiently far apart so that an accurate setting of the radio receiver may be readily obtained. If desired, numbers may be associated with the kilocycle calibrations in order to indicate or show the numerical value or amount of the kilocycles.

In order to show fractional positions of the pointer 52 with respect to the kilocycle calibrations of the wave length bands a vernier pointer 70 is provided. This pointer is fixed to and radiates from the outer or front end of the sleeve 25. The latter projects through the center of the glass plate 53 and serves during setting of the condenser to rotate the pointer 70. The latter is adapted to swing 360° and due to the character and type of gearing which is employed to drive the shaft 26 and the pointer 52 swings once around the dial 51 during a 30° travel of the pointer 52. By employing the vernier pointer 70 it is possible accurately to set the radio receiver to receive programs from any broadcasting sta-

tion. In order to facilitate adjustment or setting of the radio receiver a scale 71 is associated with the vernier pointer 70. This scale encircles the high wave length band 55 and consists of graduations 71a which as shown in Figure 1 of the drawings are sixty in number and are arranged in an annular series. Numerals such, for example, as the hour markings of a clock are associated with several of the numerals 71b to facilitate proper positioning of the vernier pointer in connection with locating any given or known radio broadcasting station.

In order to illuminate the dial 51 an electric light 72 is mounted at each side of the frame 54. The lights 72 are disposed in sheet metal housing 73 on the frame sides, and light therefrom is permitted to pass into the space between the glass disk 64 and the dial 51 by way of slots 74 in the side parts of the marginal flange 58 of the frame 54. In order to produce an iridescent effect the numerals and graduations of the scale 71 and the arcs and kilocycle calibrations of the wave length bands 55, 56 and 57 are painted into grooves in the back face of the glass plate 53. This plate 53 is preferably backed with a paper facing 75 which is cemented or otherwise secured to the outer or front face of the frame 54. The lights 72 are suitably supplied with current and are controlled by a switch (not shown) which is operated by a knob 76 on the front wall c of the cabinet C.

The radio receiver R has a range switch 77 (see Figure 2) whereby it may be set for high, intermediate or low wave length reception. This switch is mounted on the bracket 9 and the improved tuning mechanism includes a device for controlling or operating the switch. This device comprises a sleeve 78 which is mounted on and is rotatable relatively to the central portion of the shaft 15. As shown in Figure 3 of the drawings the sleeve extends through the hole c^5 in the front wall c of the cabinet C, and is provided with a knob 79 whereby it may be turned. The knob is located behind the knob 19 and is fixedly secured to the front end of the sleeve by means of set-screw 80. The rear end of the sleeve is provided with a drum 81 and is connected to operate the range switch 77 by means of a belt 82 and a drum 83. The latter is mounted on a switch operating shaft 84 at one side of the bracket 20. The belt 82 extends around the drums 81 and 83 and serves in response to rotation of the sleeve 78 to rotate the shaft 84 and control the range switch 77. By mounting the sleeve 78 on the shaft 15 the device for actuating or controlling the range switch 77 is conveniently located with respect to the knob 19 and it is possible for the user of the radio receiver to operate the switch or adjust the condenser without moving his or her hand from one point on the cabinet C to another. The sleeve 78 is held against axial displacement by means of a bracket 85 which is fixed to the upstanding leg 21 of the bracket 20 and engages the front end of the drum 81.

The herein described tuning system is essentially a simple one and may be manufactured at a low and reasonable cost owing to the small number of parts and the simplicity of its construction.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination with a radio receiver having a variable condenser in the form of a stator and a rotor mounted to rotate into and out of lapped relation with the stator, a tuning system for the receiver comprising a gear train connected to rotate the rotor for tuning purposes, a knob-equipped condenser actuating shaft mounted to rotate and slide longitudinally, a driving connection between the shaft and the gear train including a pulley mounted loosely on the shaft, clutch means fixed to the shaft and adapted upon shift of the shaft in one direction to engage one end of the pulley to form a direct driving connection between the pulley and the shaft, and means adapted upon shift of the shaft in the opposite direction to form a low speed driving connection between the shaft and the pulley, said last mentioned means including an annular series of balls encircling the shaft and engaging the other end of the pulley.

2. In combination with a radio receiver having a variable condenser in the form of a plate-type stator and a plate-type rotor mounted to rotate into and out of lapped relation with the stator, a tuning system for the receiver comprising a rotatable mounted shaft having a finger knob at one end thereof for turning purposes, a sleeve shaft, a driving connection between the two shafts whereby turning of the knob equipped shaft will result in turning of said sleeve shaft, a tuning dial having a hole therein through which one end of said sleeve shaft extends, a vernier pointer adapted to coact with the dial fixed to and radiating from said one end of said sleeve shaft and a gear train between the rotor of the condenser and the other end of said sleeve shaft whereby said rotor is rotated with respect to the stator in response to turning of said sleeve shaft by the knob-equipped shaft, a third shaft centrically positioned with respect to said sleeve shaft having an end extending through said hole in the tuning dial, a main pointer fixed to and radiating from said end of the third shaft, and driving means between one of the gears of the gear train and the third shaft for rotating the third shaft at a lower rate of speed than the said sleeve shaft during turning of the latter by said knob-equipped shaft.

3. In combination with a radio receiver having a variable condenser in the form of a plate-type stator and a plate-type rotor mounted to rotate into and out of lapped relation with the stator, a tuning system for the receiver comprising a rotatable mounted shaft having a finger knob at one end thereof for turning purposes, a sleeve shaft, a driving connection between the two shafts whereby turning of the knob equipped shaft will result in turning of said sleeve shaft, a tuning dial having a hole therein through which one end of said sleeve shaft extends and also having a substantially circular scale around the hole, a vernier pointer adapted to coact with and swing over the scale of the dial fixed to and radiating from said one end of said sleeve shaft, a third shaft centrically positioned with respect to said sleeve shaft having an end extending through said hole in the tuning dial, a main pointer fixed to and radiating from said end of the third shaft, a gear train between the rotor of the condenser and the other end of said sleeve shaft whereby said rotor is rotated with respect to the stator in response to turning of said sleeve shaft by the knob equipped shaft, driving means

between one of the gears of said gear train and the third shaft whereby said third shaft together with the main pointer thereon is rotated substantially 340° in one direction when the rotor is swung from its lapped relation into unlapped position with respect to the stator and when said third shaft together with the main pointer is rotated substantially 340° in the other direction the rotor of the condenser is swung or rotated from said unlapped position into lapped relation with respect to the condenser stator and the rate of rotation of said third shaft is lower than that of the second shaft.

4. In a radio device the combination of a variable condenser actuating and indicating mechanism comprising a variable condenser having a rotatable shaft, a dial with which a main pointer and a vernier pointer are associated, a sleeve shaft to which the vernier pointer is secured, means associated with said sleeve shaft for manual operation thereof, a gear wheel separately mounted and driven from said sleeve shaft, a shaft located within said sleeve shaft to which the main pointer is secured and driving means driven by said gear wheel for turning said shaft to which the main pointer is secured and for turning the rotatable shaft of said variable condenser.

5. In combination with a radio receiver having a variable condenser in the form of a multi-plate stator and a multi-plate rotor mounted to rotate into and out of lapped relation with the stator, mechanism for visibly ascertaining the tuning adjustment of said condenser comprising a tuning dial, a main pointer and a vernier pointer coacting with the scale of said tuning dial, mechanism for tuning the receiver comprising a knob-equipped shaft, a main pointer shaft, a vernier pointer shaft concentrically positioned with respect to said main pointer shaft, a belt and pulley connection between the knob-equipped shaft and the said vernier pointer shaft, a gear train between the said vernier shaft and said main pointer shaft comprising an intermediate gear wheel, and driving means between said gear train and the rotor of the condenser whereby said rotor is swung with respect to the stator in response to the turning of the knob-equipped shaft and the relative movement and positioning of the rotor is indicated by said pointers on the tuning dial.

6. In a radio receiving device the combination of a variable condenser actuating and indicating mechanism comprising a condenser having fixed and movable plates, a rotatable condenser shaft to which said movable plates are secured, a gear wheel positioned on said shaft, a graduated scale having associated therewith a pointer for indicating coarse adjustment and a second pointer for indicating fine adjustment, a rotatable shaft to which said fine adjustment pointer is secured, a shaft mounted concentrically with the above mentioned pointer shaft to which said coarse adjustment indicating pointer is secured, manual means for rotating said fine adjustment pointer shaft, and gear means driven by said fine adjustment pointer shaft comprising a separately mounted gear wheel driver for driving said coarse adjustment pointer shaft and said first mentioned gear wheel.

7. In combination with a radio receiver having a variable condenser in the form of a plate-type stator and a plate-type rotor mounted to rotate into and out of lapped relation with the stator, a tuning system for the receiver comprising a rotatable mounted shaft having a finger knob at one end thereof for turning purposes, a sleeve shaft, a driving connection between the two shafts whereby turning of the knob-equipped shaft will result in turning of said sleeve shaft, a tuning dial having a hole therein through which one end of said sleeve shaft extends, a vernier pointer fixed to and radiating from said one end of said sleeve shaft and adapted to coact with the scale of said tuning dial, a third shaft mounted within said sleeve shaft having one end extending through said hole in the tuning dial, a main pointer fixed to and radiating from the said end of the third shaft, a gear wheel driver separately mounted and driven by said sleeve shaft, and gear means for driving said rotor by said gear wheel driver whereby said rotor is rotated with respect to the stator in response to turning of said sleeve shaft by said knob-equipped shaft and means for rotating the third shaft by said gear wheel driver at a lower rate of speed than the said sleeve shaft during turning of the latter by said knob-equipped shaft.

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