May 23, 1939. W. E. NEWMAN 2,159,749

INDICATING DEVICE

Filed Nov. 30, 1934 2 Sheets-Sheet 1

Fig. 1.

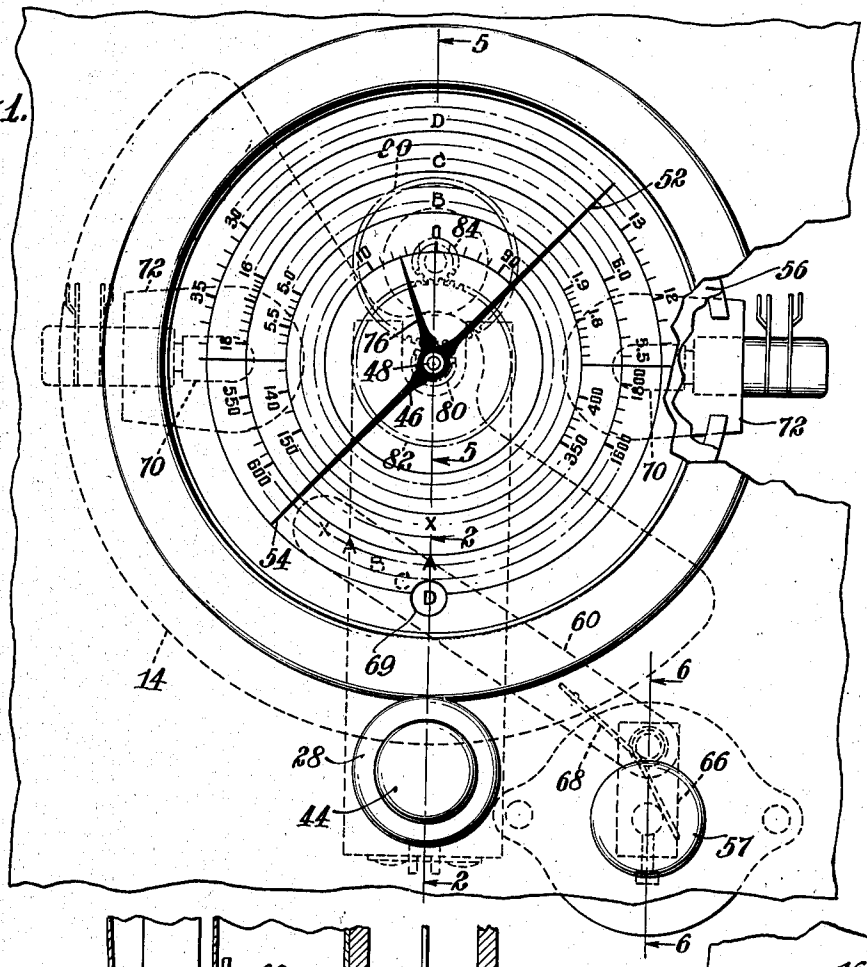



Fig. 2.

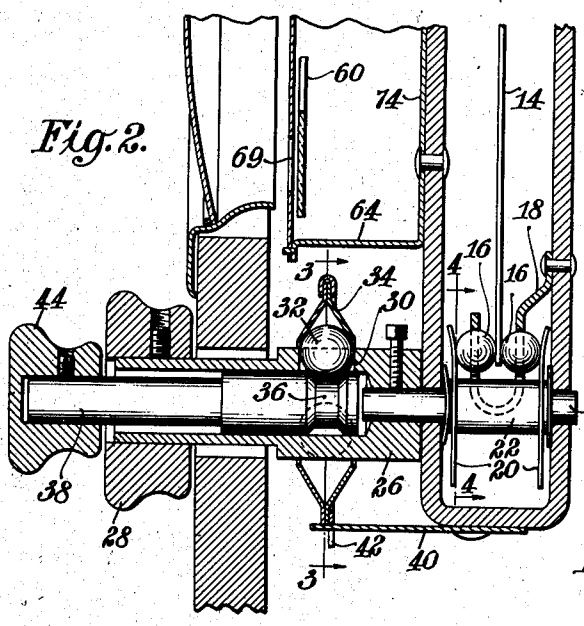
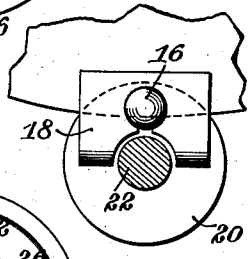



Fig. 4.



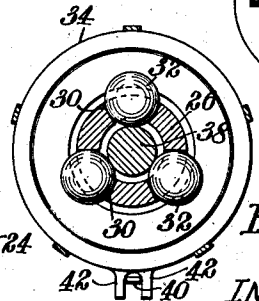




Fig. 3.

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Fig. 5.

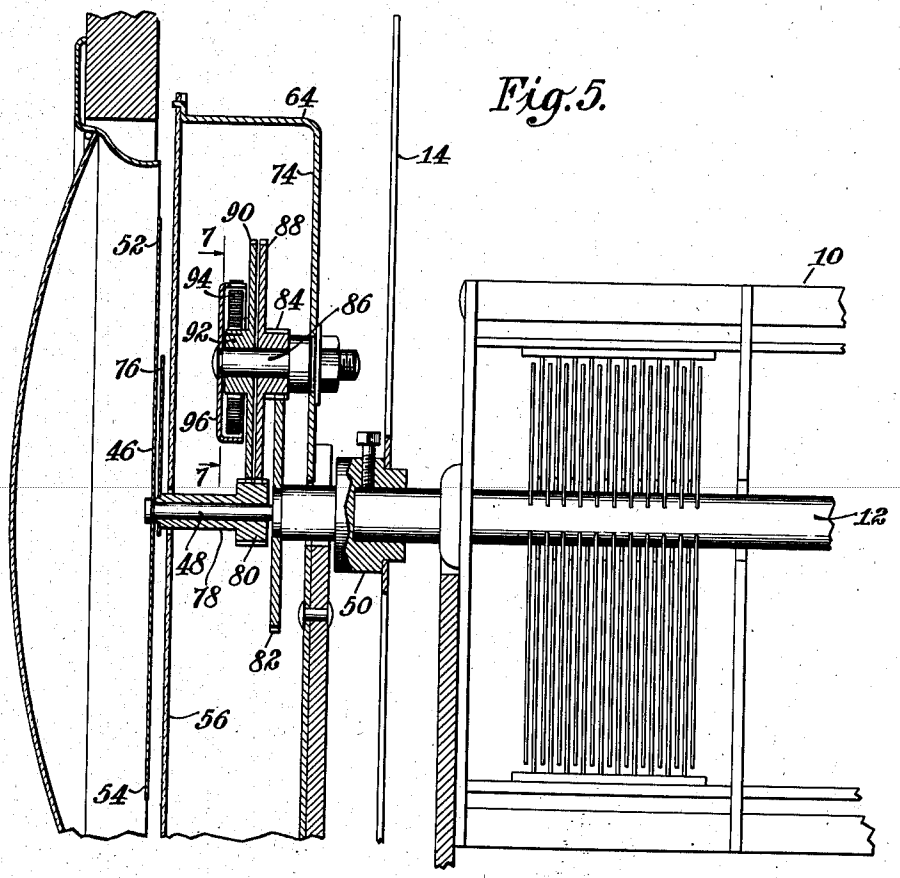



Fig. 6.

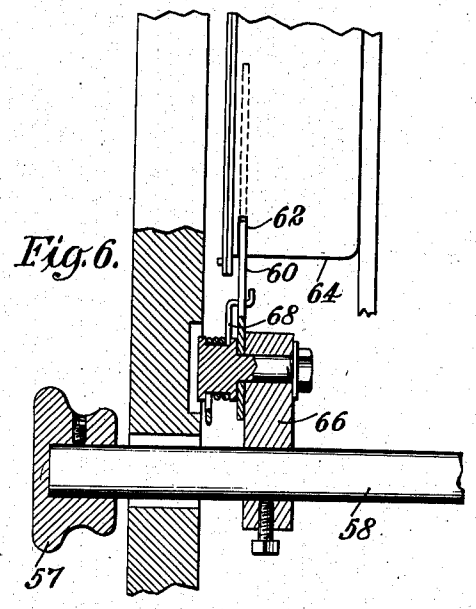



Fig. 8.

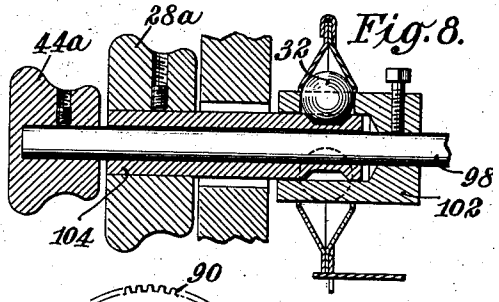
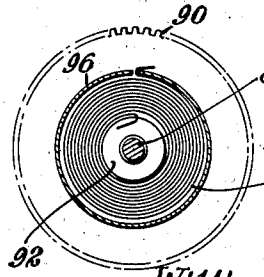



Fig. 7.




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Patented May 23, 1939 2,159,749

# UNITED STATES PATENT OFFICE

2,159,749

## INDICATING DEVICE

William E. Newman, Moorestown, N. J., assignor, by mesne assignments, to Radio Corporation of America, New York, N. Y., a corporation of Delaware

Application November 30, 1934, Serial No. 755,337

8 Claims. (Cl. 116—124.1)

My invention relates to improvements in tuning mechanism for radio receivers.

One of the objects of my invention is to provide improved tuning mechanism of the character referred to embodying a tuning element, such as a gang condenser, for tuning to different wave lengths, means for indicating the wave length or frequency to which the receiver is tuned, and means for preventing back-lash between different elements of the connecting means for causing cooperative movement of the various parts.

Another object of my invention is to provide improved tuning mechanism of the character referred to embodying a dial or other indicating element for showing the wave length or frequency to which the receiver is tuned, a vernier dial or other equivalent element for indicating incremental movements of the main dial, and means for preventing back-lash in the connecting means for causing cooperative movement of the various parts.

Another object of my invention is to provide improved tuning mechanism of the character referred to which is particularly adaptable for an all-wave radio receiver, which is provided with easily readable indicating means and which gives a correct indication of incremental movements of the gang condenser or other tuning element.

Another object of my invention is to provide improved tuning mechanism of the character referred to and wherein means are provided for readily effecting a coarse or fine adjustment of the receiver.

Other objects and advantages will hereinafter appear.

In accordance with my invention, a pointer or other indicating member is caused to move upon adjustment of the gang condenser or other tuning element to give a relatively close indication of the wave length to which the receiver is tuned, a vernier pointer or other indicating member is caused to move with the first member but at a greater rate to give an exact indication, easily readable, of the position of the first indicating member between the divisions of the associated scale over which it travels, and tensioned spring means, associated with the mechanical connections between the parts, operates to prevent any back-lash in the latter.

Further, in accordance with my invention, a differential device is so interposed and connected between the gang condenser of the receiver and two manually operable knobs, that rotation of one knob causes movement of the condenser without the reduction effect of the differential device, while rotation of the other knob causes rotation of the condenser through the differential device for relatively fine adjustment.

My invention resides in the improved construction of the character hereinafter described and claimed.

For the purpose of illustrating my invention, an embodiment thereof is shown in the drawings, wherein

Figure 1 is a front elevational view, partly broken away, of tuning mechanism constructed and operating in accordance with my invention, some of the parts being removed for the sake of clearness;

Fig. 2 is a sectional view, the section being taken on the line 2—2 in Fig. 1;

Fig. 3 is a sectional view, the section being taken on the line 3—3 in Fig. 2;

Fig. 4 is a sectional view, the section being taken on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view, the section being taken on the line 5—5 in Fig. 1;

Fig. 6 is a sectional view, the section being taken on the line 6—6 in Fig. 1;

Fig. 7 is a sectional view, the section being taken on the line 7—7 in Fig. 5; and

Fig. 8 is a view similar to Fig. 2, showing a modification.

In the drawings, the reference numeral 10 designates a gang condenser whose shaft 12 is rotatable through a given range of about 180°.

For the purpose of rotating the shaft 12 to make adjustments in tuning, a plate 14 is fixed thereto. The edge of this plate is disposed between balls 16 held by a part 18 for free rotation or rolling movement, but against bodily movement.

The balls 16 are held pressed against the opposite sides of the plate 14 by the resilient sides 20 of a spool 22 which is fixed on a stubshaft 24.

The stubshaft 24 is rotated upon rotation of a hollow shaft 26 fixed thereto and provided with an operating knob 28. The hollow shaft 26 is provided with openings 30 in which balls 32 are disposed for free rotation.

A ball race 34 is disposed about the shaft 26, as shown, and operates to hold the balls in position in the openings 30 and in an annular groove 36 in the end of a shaft 38. The ball race 34 is held against rotation by a fixed element 40 whose end extends between spaced lugs 42 with which the race is provided.

The shaft 38 is rotatable within the hollow shaft 26, and is provided with an operating knob 44.

For the purpose of making relatively rough adjustments of the condenser 10, the knob 28 is rotated to cause like rotation of the spool 22 without the reduction effect of the differential device of which the balls 32 form a part. In such case, the balls 32 move bodily with the shaft 26 about the axis of rotation thereof, the reduction between the knob 28 and the condenser shaft 12 being only that provided by the balls 16 and associated parts.

For the purpose of making fine adjustments of the condenser, the knob 44 is rotated to effect rotation of the balls 32, causing them to travel about the race 34 and rotate the shaft 26 and spool 22 at a reduced rate. By rotation of the knob 44, therefore, the condenser shaft 12 is rotated at a reduced rate not only by the balls 16 and associated parts, but through the differential device associated with the shafts 26 and 38.

To provide an indication of the angular position of the rotor of condenser 10, an indicating member 46 is fixed to the end of a spindle 48 coaxial with the condenser shaft 12 and extending outwardly from a part 50 fixed to the latter and which carries the plate 14. The member 46 is comprised of two pointers 52 and 54 extending in diametrically opposite directions, and moves over a fixed dial 56 provided concentrically about its center and at different distances radially therefrom with the different scales A, B, C, D and X, for the various bands over the entire frequency range for which the receiver is designed. From the foregoing, it will be understood that angular movement of the member 46 is the same as that of the condenser shaft 12.

In changing from one band to another, a knob 57 is rotated to turn a shaft 58 connected to a conventional wave-change switch (not shown). The particular band for which the receiver is set to operate is indicated by the position of an elongated member 60 which has a sliding fit through an opening 62 in the casing 64 and is pivotally connected, as shown, to a crank arm 66 fixed to the shaft 58. A tensioned coil spring 68, associated with the pivotal connection for the member 60, operates to bias the latter in a counter-clockwise direction, as viewed in Fig. 1 whereby it is always held against the lower edge of the slot 62. The member 60 is provided with designations corresponding, respectively, to those on the dial 56 for the different bands, and which are displayed through an opening 69 in the dial 56.

In Fig. 1, the wave-change knob 57 is shown in the position for reception over the band D, in which case the reading for the frequency to which the receiver is tuned is taken according to the position of the pointer 52 along the scale D. When the wave-change knob 57 is rotated in the clockwise direction to expose the designation X through the opening 69, the receiver will be set for reception over the band X, in which case the reading will be made according to the position of the pointer 54 with respect to the scale X. In the intermediate positions of the knob 57, the designations A, B and C will be displayed through the opening 69, to indicate to the operator the respective scale which is then to be used to indicate the wave length to which the receiver is tuned.

The entire dial 56 is illuminated uniformly by lamps 70. Part of the light from the lamps 70 passes through translucent members 72. The rest of the light from these lamps is reflected from the members 72 to the face 74 of the casing 64, and is then reflected from this face to the dial 56.

Incremental movements of the member 46 are indicated by a second indicating member in the form of a vernier pointer 76 which is fixed on an extension 78 from a pinion 80 rotatable on the spindle 48. The pointer 76, upon rotation of the condenser shaft 12, is rotated through a gear train comprising a gear 82 fixed on the part 50, a pinion 84 rotatable on a stubshaft 86 fixed to the casing 64, and meshing with the gear 82, and a gear 88 fixed for rotation with the pinion 84 and meshing with the pinion 80. There is a substantial step-up ratio from the shaft 12 to the vernier pointer 76, as will be seen, whereby an incremental movement of the pointer 46 is accompanied by a substantial movement of the pointer 76.

For the purpose of preventing back-lash in the gear train, a gear 90 is mounted for rotation on the stubshaft 86, and meshes with the pinion 80. This gear is similar and adjacent to the gear 88, and is provided with a hub 92 to which one end of a coil spring 94 is fixed.

The other end of this spring is fixed to the wall of a casing 96. The end of the stubshaft 86 extends through the center of the casing 96 and is riveted over as shown to fix the latter against rotation.

In assembling the parts, the pinion 80 is moved out of mesh with the gears 88 and 90, and the gear 90 is rotated in a clockwise direction, as viewed in Fig. 7, to wind up the spring 94 whereby the same is place in tension. The pinion 80 is then moved to the right, as viewed in Fig. 5, to place it in mesh with the gears 88 and 90. The tension in the spring 94 is sufficient to rotate the vernier pointer 76, but is not great enough to disturb the setting of the condenser shaft 12. This is on account of the positive mechanical connection between the spool 22 and the condenser shaft, at the reduction ratio.

The arrangement and relation of the pinions and gears comprising the gear drive is such that upon rotation of the condenser shaft 12 through its entire range of about 180°, the vernier pointer 76 rotates through a number of complete revolutions over the innermost scale on the dial 56. Furthermore, the respective dimensions and relation of the parts with respect to each other are such that for movement of the member 46 across any one division on the dial 56, the vernier pointer 76 will move over a substantial number of divisions of its associated scale. For this reason, incremental movements of the member 46 can be easily read by reference to movement of the vernier pointer 76 with respect to its scale.

The tension in the spring 94 operates at all times to urge the vernier pointer 76 in a clockwise direction, as viewed in Fig. 1. In this way, contact is always maintained between the same respective sides of the teeth of the pinions and gears of the gear train during rotation of the condenser shaft 12 in either direction. Upon rotation of the condenser shaft 12 in the clockwise direction, looking toward the right in Fig. 5, the vernier pointer 76 will be permitted to rotate in this direction under the action of the spring 94, the tension of which will then decrease correspondingly. Upon reverse rotation of the shaft 12, the vernier pointer 76 will be rotated in the opposite direction by the positive mechanical connection provided by the gears and pinions of the gear train, at which time the spring 94 will be rewound to increase the tension therein.

In the modification shown in Fig. 8, the shaft 98 corresponds to the shaft 24 in Fig. 2 and is provided with an operating knob 44a for making relatively coarse adjustments of the condenser. The part 102 is fixed on the shaft 98, and corresponds to the part or hollow shaft 26 in Fig. 2. The shaft 98 extends loosely through a hollow shaft 104 provided with an operating knob 28a and which corresponds to the shaft 38 in Fig. 2. In this construction, therefore, the relatively fine adjustments are made through the differential device, comprising the balls 32 and associated parts, upon rotation of the knob 28a. The relatively coarse adjustments are made by rotation of the knob 44a which is connected directly through the shaft 98 to the spool 22.

From the foregoing it will be seen that I have provided improved tuning mechanism for an all-wave radio receiver in which vernier indicating means are provided for showing incremental movements of the tuning element and in which provision is made for preventing back-lash between the operating connections.

Furthermore, in my improved tuning mechanism, means are provided for readily making either relatively coarse or relatively fine adjustments by the turning of selected knobs.

While but one modification of my invention has been disclosed, it will be understood that various modifications are possible without departing from the spirit of my invention or the scope of the claims.

I claim as my invention:

1. In tuning mechanism, a rotatable drive shaft having a given range of movement, means driven by said shaft for indicating the angular position thereof, vernier indicating means providing a visual indication of incremental movements of said first-named indicating means, a gear-train for driving said vernier indicating means from said shaft with a step-up ratio from the latter to the former, and a tensioned spring having one end thereof fixed against movement and its other end fixed for movement with one of the gears in said train to cause the spring tension to increase upon rotation of said shaft in one direction and to cause the spring tension to decrease upon rotation of said shaft in the opposite direction.

2. In tuning mechanism, a rotatable drive shaft having a given range of movement, means driven by said shaft for indicating the angular position thereof, vernier indicating means providing a visual indication of incremental movements of said first-named indicating means, tensioned spring means for driving said vernier indicating means in one direction, connecting means between said shaft and said vernier indicating means for driving the latter in the opposite direction and simultaneously increasing the tension in said spring means upon rotation of said shaft in one direction, rotation of said shaft in the opposite direction operating through said connecting means to release said spring means for the purpose set forth.

3. In combination, a rotatable indicating member, means comprising a gear-train for rotating said member, a gear similar to and supported adjacent one of the gears in said train for relative rotary movement with respect thereto and meshing with the same adjacent gear with which said second-named gear meshes, a tensioned coil spring associated with said first-named gear and having one end fixed thereto, and means stationary with respect to each of the gears in said train and to which the other end of said spring is fixed whereby said spring is effective to prevent back-lash in said gear-train during rotation of said indicating member in either direction.

4. In combination, a rotatable indicating member, a second indicating member supported adjacent to and for rotation about the axis of rotation of said first-named member, means for rotating said first-named member, a gear-train connection between said means and said second-named member for rotating the latter at a greater rate than said first-named member, a gear meshed in said train and supported adjacent to one of the gears therein for rotation with respect thereto, a tensioned coil spring associated with said first-named gear and having one of its ends fixed thereto, and means fixing the other end of said spring against movement to hold the latter in tension whereby back-lash in said gear train is prevented.

5. In combination, a driving shaft, a driven shaft, an indicator on said driven shaft for indicating variations in the angular position of said driving shaft, a pinion on said driven shaft, means connecting said shafts and including at least two gears meshing with said pinion, means supporting said gears for independent rotation about a common axis, a tensioned spring connected to one only of said gears and operating by virtue of its tension to transmit torque through said gear and pinion to the said other gear, whereby to oppose rotation of said driven shaft when said driving shaft is rotated in one direction and to assist rotation of said driven shaft when said driving shaft is rotated in the other direction.

6. In apparatus of the character described, the combination of a dial having a plurality of concentrically arranged sets of arcuate scales and a circular scale displayed thereupon, a plurality of pointers arranged to turn about a common axis, one of said pointers being double-ended with its diametrically opposite end-parts registering with different scales of said sets of arcuate scales and a second of said pointers registering with said circular scale, driving means, speed-reducing transmission means connecting said driving means with said one of said pointers, and speed-increasing transmission means connecting said one of said pointers with said second of said pointers.

7. In apparatus of the character described, the combination of a dial having a plurality of differently graduated semi-circular scales and an evenly graduated circular scale displayed thereupon, said plurality of scales being concentrically arranged and representing different tuning wave bands and said circular scale spaced radially from said plurality of scales and representing fractional adjustments only, a plurality of pointers of different lengths arranged to turn upon a common axis, one of said pointers registering with said plurality of scales and a second of said pointers registering with said circular scale, and driving means connected with said pointers to effect their simultaneous operation at relatively different speeds.

8. The combination, with the rotatable shaft of an adjustable radio tuning element, a driving shaft and transmission means connecting said shafts whereby one revolution of said driving shaft will effect a partial revolution of said rotatable shaft, of a dial having a plurality of differently graduated semi-circular scales and an evenly graduated circular scale displayed thereupon, said plurality of scales being concentrically

arranged and representing different tuning wave bands and said circular scale spaced from said plurality of scales and representing fractional adjustments only, a plurality of pointers of different lengths arranged to turn upon a common axis, one of said pointers registering with said plurality of scales and a second one of said pointers registering with said circular scale, and transmission means connecting said pointers with each other and with said rotatable shaft whereby the operation of said driving shaft will effect the simultaneous movement of said pointers at relatively different speeds.

WILLIAM E. NEWMAN.