July 7, 1942. W. P. LEAR ET AL 2,288,722

RADIO TUNING MECHANISM

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Fig. 1

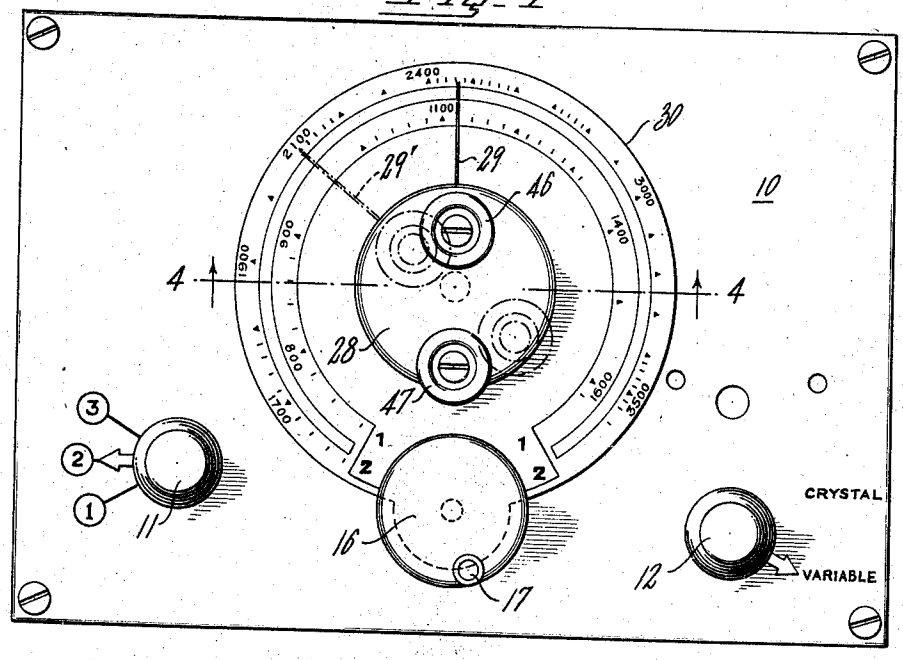


Fig. 2

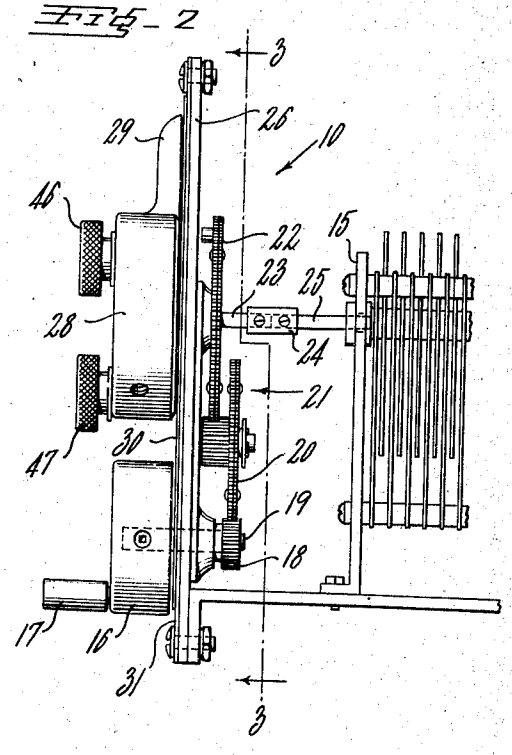
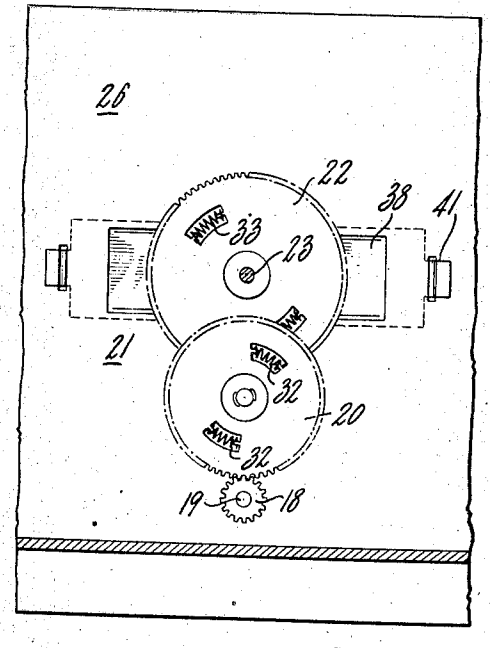


Fig. 3



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Fig. 4

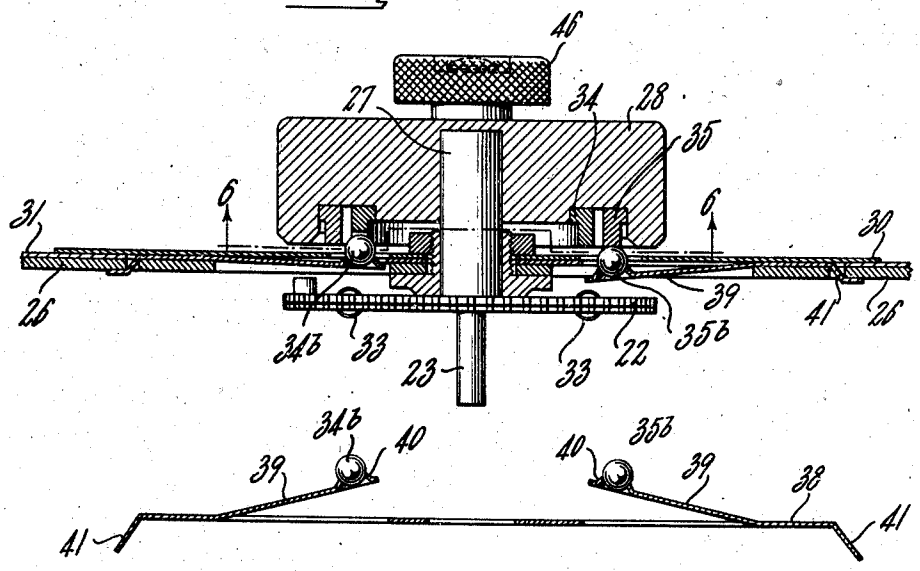


Fig. 5

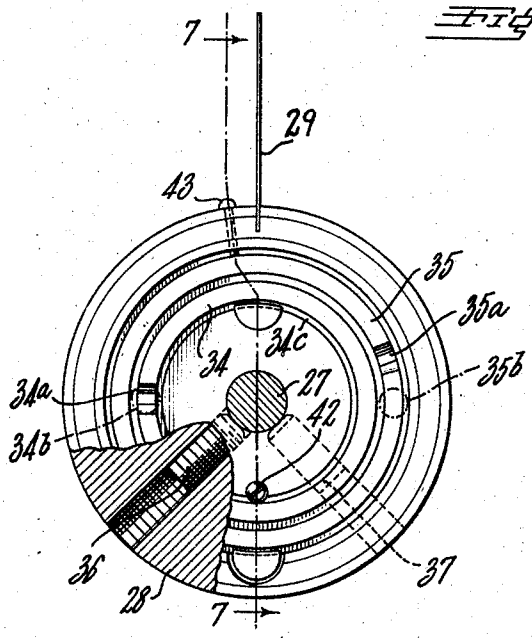


Fig. 6

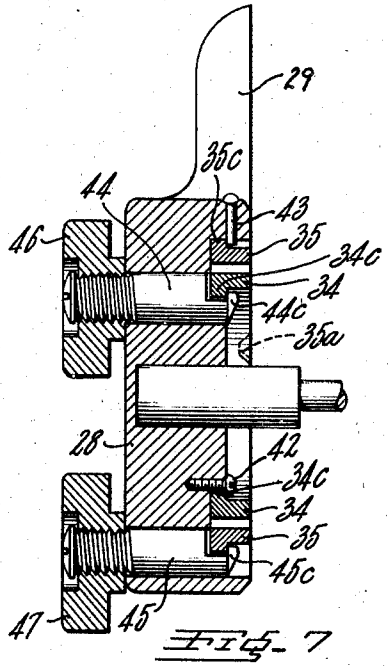


Fig. 7

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UNITED STATES PATENT OFFICE

2,288,722

RADIO TUNING MECHANISM

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Application November 7, 1940, Serial No. 364,660

6 Claims. (Cl. 74—10)

This invention relates to tuning systems for electronic devices such as radio transmitters and radio receivers, more particularly relating to frequency preselecting arrangements associated with the tuning systems.

In accordance with the present invention, means are provided for enabling the operator to preselect frequencies of a continuously tunable system without operating accessory levers, push-buttons, or the like. The preselecting means is operative whenever the system is tuned to or past the preselected frequency positions. When other than the preselected frequencies are required, the tuning is performed in the usual manner with no effective interference by the preselecting mechanism.

It is among the objects of the present invention to provide a preselecting tuning system of simplified construction, and which is readily readjustable. The invention is particularly applicable for aircraft radio transmitters or receivers. When the tuning knob of the radio set is operated by the pilot in the normal manner, the preselected frequency positions become directly apparent to him by an increased resistance to tuning at these positions. Should he desire the setting to one of the preselected frequencies, he merely turns the tuning knob near to the desired frequency position, and the selected mechanism accurately completes the tuning to the exact position. When other frequency positions are required, the pilot tunes past the preselected positions by merely overcoming the detention resistance. He operates the usual tuning knob throughout.

Further objects, advantages and capabilities of the invention will appear in the following description of a preferred embodiment thereof illustrated in the drawings, in which:

Fig. 1 is an elevational view of the panel of a radio set incorporating the preselecting tuning arrangement.

Fig. 2 is an end view of a portion of the radio set, showing the tuning system.

Fig. 3 is a view of the tuning arrangement taken along the line 3—3 of Fig. 2.

Fig. 4 is a cross-sectional view through the preselecting mechanism, taken along the line 4—4 of Fig. 1.

Fig. 5 is a cross-sectional view through a detail of the preselecting mechanism.

Fig. 6 is a cross-sectional view through the tuning arrangement taken along the line 6—6 of Fig. 4.

Fig. 7 is a cross-sectional view through the portion of the preselecting mechanism, as taken along the line 7—7 of Fig. 6.

The tuning system of the invention may be applied to any type of radio or electronic device employing continuous tuning adjustment. The illustrated radio set 10 may either be a transmitter or receiver with the usual circuit components for transmitting or receiving radio frequency waves through a continuous range of frequencies. Radio set 10 incorporates two frequency bands indicated at 1 and 2. A different number of bands may be employed. Selector knob 11 is used to arrange the circuits of set 10 to conform with the indicated frequency bands. Position 3 is an optional one, and may for example, transform the set to a different mode of operation. Knob 12 may be used to change the circuit of the set between variable and crystal frequency control, as will be understood by those skilled in the radio art.

The tuning system and associated frequency preselecting mechanism of the invention is independent of the type, mode of operation, or particular radio circuit used. A variable condenser 15 shown as the member for varying the frequency of the circuit. Variable inductance or other frequency determining means may instead be incorporated. The tuning is manually effected by the rotation of knob 16 through projecting handle 17. A pinion 18, secured to the shaft 19 on which knob 16 is fastened, meshes with gear 20 of gear train 21. End gear 22 of the gear train is suitably secured to shaft 23 which is coupled by member 24 to tuning shaft 25 of variable condenser 15.

Part of the preselecting mechanism of the invention is mounted on panel 26, and another part is secured to extension 27 of tuning shaft 23. The mechanism comprises a cap or housing 28 from which a pointer 29 extends over the frequency calibrated dials 1 and 2. The dials are on escutcheon plate 30 attached to auxiliary panel 31 which is fastened onto main panel 26. Gears 20 and 22 are of an anti-backlash type arranged individually as split gears internally spring biased apart through springs 32 and 33 respectively. One split gear of each pair is fastened to its shaft, the other one being free therefrom. These gears assist in the tuning by eliminating backlash. They also act as a flexible connection between tuning shaft 23 and tuning knob 16, to permit a freer action of the preselecting mechanism to be described in detail hereinafter.

The illustrated preselecting mechanism com-

prises annular ball races 34 and 35 concentrically mounted within a grooved open end of cap 28. As seen in Fig. 4, races 34, 35 project from cap 28, towards the panel 26. Cap 28 is fastened to tuning shaft extension 27 by set screws 36 and 37 extending through the cap 28 at different radial positions, as seen in Fig. 6. Races 34 and 35 individually contain a notch or recess 34a and 35a respectively for coaction with individual balls 34b and 35b arranged adjacent the respective races 34 and 35.

Balls 34b, 35b preferably are of hardened steel. A ball retainer member 38 contains leaf springs 39, the ends of which are arranged with cups 40 for the balls. The length of each leaf spring 39 is such as to insure proper positioning and coaction of the balls 34b, 35b with the faces of respective races 34, 35. Projections 41 from the ends of ball retainer 38 are used to grip the retainer on panel 26, as shown in Fig. 4. Leaf springs 39 press the respective balls into frictional contact with the ball races. Retainer spring 38 is relatively fixed in position. In view of their resilient support by the leaf springs, balls 34b, 35b are accordingly restrained to be moved only in a path transverse to the panel 26, namely towards or against ball races 34, 35.

The ball races 34, 35 arranged within cap 28 are normally rotatably displaceable therein. Inner ball race 34 is held in position in cap 28 by retainer screw 42 bearing against its annular projection 34c. Outer ball race 35 is held in position in cap 28 by retainer pin 43 bearing against its lateral annular projection 35c. A locking screw 44 is provided for inner race 34; and locking screw 45, for outer race 35. Locking screws 44, 45 project through cap 28 to the respective races. They contain respective hooked projections 44c, 45c overlapping the annular projections 34c, 35c of the ball races.

Races 34, 35 are normally free to ride within cap 38, being generally supported therein by the respective retainer pins 42, 43 and locking screw projections 44c, 45c. When ball 34b or 35b engages its respective notch 34a or 35a, the respective race 34 or 35 is prevented from rotating with tuning shaft 23 and cap 28. A loose and engaged ball race would thus be stationary despite tuning movement. Knurled thumb nuts 46, 47 are threaded onto the threaded extensions of respective locking screws 44, 45 as shown in Fig. 7. Each locking screw 44, 45 is operable to hold its respective ball race in fixed relation with respect to cap 28 and shaft 23 through the tightening of its associated thumb nut. Operating a thumb nut 46 or 47 towards cap 28 forces its respective locking screw 44 or 45 up into cap 28, and presses the associated projection 44c or 45c thereof against annular rim 34c or 35c of the associated ball race. In this manner, either ball race 34 or 35 may be held affixed or locked in position with respect to cap 28.

When cap 28 is rotated upon tuning movement of the radio set, the ball race which is fastened with cap 28 moves therewith and disengages its notch 34a or 35a from balls 34b, 35b. Such disengagement entails an increased torsional resistance to the movement or rotation of the tuning knob 16. Also, when either notch 34a or 35a of a locked ball race reaches its associated ball in the tuning, leaf spring pressure on the ball forces it into the notch with a snap action. Race notches 34a and 35a have inclined wall surfaces as shown in Figs. 6 and 7, affording a gradual sliding action in the engagement or disengagement between a race and relatively fixed ball.

The operation of the preselecting tuning mechanism of the invention will now be described. With the described system, two separate frequencies may be individually preselected for any one tuning band, corresponding to the operation of either ball race with its associated spring pressed ball. The external thumb nuts 46 and 47 are for adjusting to the desired individual frequencies in a band. Nuts 46 and 47 are preferably of different colors to assist in their identification. To preset inner ball race 34, its notch 34a is moved into engagement with associated ball 34b, and thumb nut 46 is loosened. Thumb nut 46 may be loosened prior or subsequent to the engagement of ball and notch. Tuning knob 16 is rotated until the engagement is effected. Engagement of the notch and its associated ball is ascertained by a snapping sound occurring if nut 46 is first loosened, or otherwise by an increased torsional resistance. It is immaterial whether the notch and ball engagement is effected prior or subsequent to the loosening of the locking screw 44.

Tuning knob 16 is thereupon turned until indicator 29 is opposite the frequency position it is desired to preselect. Thumb nut 46 is then tightened against cap 28, forcing projection 44c, of locking screw 44, against ridge 34c of inner ball race 34. The inner ball race is thus locked with cap 28 in a predetermined angular position corresponding to the frequency desired. In subsequent tuning operations on the radio set, increased torsional resistance will occur as the indicator reaches the preselected frequency position.

When, for example, indicator 29 is in the solid position of Fig. 1, opposite the 1120 kilcocycle position on band No. 1 (or 2465 kilocycles on band No. 2), the notch of inner ball race 34 engages ball 34b. The one of these two frequencies to which the set becomes tuned depends upon the frequency band selected. As the indicator approaches the preselected position, the inclined sides of notch 34a engage the relatively stationary ball 34b. The leaf spring presses ball 34b into notch 34a, pressing on its inclined sides to force the tuning shaft to the predetermined position, corresponding to when the ball 34b is fully seated in notch 34a, as indicated in Figs. 4 and 6.

Thus, as indicator 29 approaches the preselected frequency position from either direction of rotation, the detent tuning mechanism of the invention assumes control of the tuning movement. The force and extent of such control is determined by the angle of the inclined walls of the notch in the ball race, and the pressure by leaf spring 39. The result is a snapping of the ball into the notch, restraining the tuning mechanism to the preselected position when engagement is effected. The engagement is communicated to the operator by an increased rotational or torsional resistance in the operation of the tuning knob 16. Also, the snapping sound may be heard. This sound, however, is unimportant in a noisy background occurring in an airplane cockpit. Should the operator desire to pass the preselected frequency position, an increased tuning effort disengages the ball race for either direction of tuning.

A second frequency is preselected by outer ball race 35, in a manner similar to the described preselection with inner ball race 34. Thumb nut

47 is operated for the outer ball race, independently of thumb nut 46 or inner ball race 34. The frequency position preselected for outer ball race 35 corresponds to the position of indicator 29 when notch 35a is in engagement with its associated relatively fixed ball 35b. The position of notch 35a shown in Fig. 6, corresponds to a frequency position of the indicator shown in dotted lines at 29' in Fig. 1, opposite the 2100 kilocycle position on band No. 2 (or 960 kilocycles on band No. 1).

With the system of the invention, the preset frequencies may readily be changed by simply loosening the respective thumb nuts 46 and 47 and following the preselection procedure outlined. Whereas only two races with associated detent preselecting components have been illustrated, it is to be understood that more than two may similarly be arranged within a single cap or housing. Individual locking screws and thumb nuts would project from such housing for controlling the setting of the ball races. Also, individual balls would be arranged for coaction with the additional races. Furthermore, the races need not be annular but may have any desired arcuate or linear disposition.

The frequency preselected by any one preselecting unit may lie on any frequency band of the radio set. The actual location of the mechanical detent or preselecting mechanism, (corresponding to the cap, the ball races, and the associated spring pressed balls), may be other than directly on tuning shaft 23. It is sufficient that it be inserted somewhere between the tuning knob and the tuning shaft of the variable tuning device.

It is to be understood that modifications may be made in the illustrated embodiment, without departing from the broader spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. Tuning mechanism comprising a cap with an extending index secured to the tuning shaft, a race having a laterally extending rim, means adjustably mounting said race with said cap, a post extending through the front of said cap incorporating a projection engaging said rim, screw means on said post for adjustably locking the race for rotation with said cap, and a spring-pressed element supported on a fixed panel behind said cap in engagement with said race for predetermined detent actuation of the tuning shaft through said cap and the associated race.

2. Tuning mechanism comprising a cap with an extending index secured to the tuning shaft, a circular ball race having a surface notch and a laterally extending rim, means adjustably mounting said race within a recess in said cap, a post extending through the front of said cap incorporating a projection engaging said rim, screw means on said post for adjustably locking the race for rotation with said cap, and a spring-pressed ball supported on a fixed panel behind said cap in engagement with said race substantially in the plane of the panel for predetermined detent actuation of the tuning shaft through said cap and the associated race notch.

3. Tuning mechanism comprising a cap with an extending index secured to the tuning shaft, a plurality of concentric races each having a laterally extending rim, means adjustably mounting said races with said cap, a post for each of said races extending through the front of said cap incorporating a projection engaging the corresponding rim of each race, screw means on each post for adjustably locking the corresponding race for rotation with said cap, and a spring-pressed element supported on a fixed panel behind said cap in individual engagement with each of said races substantially in the plane of the panel for predetermined detent actuation of the tuning shaft through said cap and the associated race notch.

4. Tuning mechanism comprising a cap with an extending index secured to the tuning shaft, a ball race having a surface notch and a laterally extending rim, means adjustably mounting said race within a recess in said cap with the outer race face substantially flush with the rear face of said cap, a locking screw extending through the front of said cap incorporating a projection engaging said rim, screw means on said post for adjustably locking the race for rotation with said cap, a leaf spring having one end supported on a fixed panel behind said cap and another end arranged to extend adjacent said race, a ball carried by the extending spring end, said ball being spring-pressed against said race to effect predetermined detent action on the tuning shaft through said cap and associated notch.

5. Tuning mechanism comprising a cap with an extending index secured to the tuning shaft, a plurality of concentric ball races each having a surface notch and a laterally extending rim, means adjustably mounting said races within a recess in said cap, a locking screw for each of said races extending through the front of said cap incorporating a projection engaging the corresponding rim of each race, screw means on each locking screw for adjustably locking the corresponding race for rotation with said cap, a plurality of leaf springs each having one end supported on a fixed panel behind said cap and another end arranged to individually extend adjacent one of said races, a ball carried by each extending spring end, said balls being spring-pressed against their individual race to effect predetermined detent action on the tuning shaft through said cap and the associated notch.

6. Tuning mechanism comprising a cap with an extending index secured to the tuning shaft, a plurality of concentric ball races each having a surface notch and a laterally extending rim, means adjustably mounting said races within a recess in said cap with the outer race faces substantially flush with the rear face of said cap, a post for each of said races extending through the front of said cap incorporating a projection engaging the corresponding rim of each race, screw means on each post for adjustably locking the corresponding race for rotation with said cap, a plurality of leaf springs each having one end supported on a fixed panel behind said cap and another end arranged to individually extend adjacent one of said races, a ball carried by each extending spring end, said balls being pressed against their individual race whereby said leaf springs are bent through corresponding openings in the panel when said balls ride on said races and spring-press said balls into the associated race notch to effect predetermined detent action on the tuning shaft through said cap.

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