ABSTRACT

An automatic tuning assembly for a radio receiver includes a link arrangement having a pair of members joined together for movement with respect to each other and each being pivotal about a separate pivot point for coupling a drive motor to the rotatable tuner drive shaft of the receiver to vary automatically the frequency setting of the tuner assembly and simultaneously therewith for decoupling the manual tuning control knob, respectively. The members are pivoted in response to the actuation of a solenoid, the armature of which is connected to one of the joined members.

6 Claims, 6 Drawing Figures
AUTOMATIC TUNING APPARATUS FOR A RADIO RECEIVER

BACKGROUND

This invention relates generally to radio receivers and more particularly to automatic tuning apparatus for such radio receivers.

In automatic or "searching" type radio receivers wherein a switch is operated to activate apparatus including a drive motor for changing the positioning of the tuner assembly until a predetermined frequency setting is found, in addition to the requirement for connecting up the drive motor for operation, it is desirable that the manual tuning knob of the receiver be disconnected to reduce the load on the drive motor and to prevent the knob from turning during the automatic tuning operation.

While prior art search tuning type radio receivers are known in which the manual tuning knob remains stationary during the search tuning operation, complicated mechanisms are often employed to disengage the tuning knob. In addition, extra hardware which is often needed, requires additional space in the chassis of the radio receiver and increases the cost of the unit.

SUMMARY

Accordingly, it is an object of the present invention to provide in a radio receiver, new and improved "search tuning" apparatus for coupling a drive motor to the tuner assembly.

It is another object of the present invention to provide a search tuning radio receiver of the above described type wherein upon actuation of the automatic tuning apparatus, the manual tuning knob is disconnected and prevented from rotating.

It is still another object of the present invention to provide in an automatic or search tuning radio receiver of the above described type, a mechanism which serves both to engage the drive motor for automatic operation and simultaneously therewith to disengage the manual tuning knob of the receiver.

It is yet another object of the present invention to provide an automatic or search tuning radio receiver of the above described type which is relatively low in cost.

Briefly, a preferred embodiment of search tuning apparatus for a radio receiver according to the invention includes a solenoid which is operated upon the depression of a search tuning actuator bar to pivot a coupled plate and L-shaped member each about a pivot point. A first leg extending from the plate engages a declutching bar which disengages the halves of a clutch mechanism to in turn decouple the manual tuning knob gear assembly and thereby to prevent rotation of the manual tuning knob during automatic tuning. A leg of the L-shaped member connects up a gear driven by a drive motor, to a drive shaft rotatable to drive the tuner assembly to varying frequency settings for automatic searching. The solenoid and drive motor are actuated simultaneously upon operation of the automatic or search tuning actuator switch.

DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a perspective view of a radio receiver incorporating automatic search tuning apparatus according to the invention;

FIG. 2 is a fragmentary rear view of the radio receiver unit of FIG. 1;

FIG. 3 is a perspective view of a drive motor and planetary gear mechanism used in the radio receiver of FIG. 1 to drive the slug tuning assembly thereof during automatic tuning;

FIG. 4 is a perspective view of a solenoid and link arrangement for engaging the drive motor and disengaging the manual tuning knob of the radio receiver of FIG. 1 during automatic tuning;

FIG. 5 is a top, isometric view of the manual tuning knob declutching and drive motor gear arrangement of the radio receiver of FIG. 1; and

FIG. 6 is a circuit diagram for the radio receiver of FIG. 1, illustrating the operation of the automatic tuning apparatus thereof.

DETAILED DESCRIPTION

Referring now to the drawings in greater detail wherein like numerals have been employed to designate similar parts throughout the various views, there is shown in FIG. 1 a radio receiver 10 incorporating automatic or search type tuning apparatus 12 (FIG. 2) according to the invention.

The radio receiver includes an outer housing or case 14 having a front panel 16. Five manually activated pushbuttons 18 extend from front panel 16 and are provided to change the frequency setting of the radio receiver between five corresponding preselected settings. The manual pushbuttons and associated elements are of a conventional type and as such will not be described in detail herein. A manual tuning knob 20 extends from panel 16 and is provided to adjust manually the frequency setting of the receiver 10. A volume/on-off knob 22 is provided adjacent knob 20. An indicator arm 24 and dial 26 are located above pushbutton 18 to visually indicate the frequency setting of the radio receiver at any given time. A switch 28 is provided to adjust the radio frequency band between AM and FM, and an automatic tuning actuator bar 30 is provided beneath the knobs 20, 22 for actuating the automatic or search tuning apparatus 12 of the radio receiver.

As seen in FIG. 2, the radio receiver 10 includes a standard slug or core type tuner assembly 32. The assembly includes a plurality of tuning coils 34 into which corresponding tuning slugs or cores 35, all mounted on a common carriage assembly (not shown) are moved to change the radio frequency setting of the radio receiver. The carriage assembly which can be of the conventional "treadle bar" type, is driven by a shaft 36 connected thereto through a rotatable gear member (not shown) and rotatable hub 38. The carriage itself will not be discussed herein in detail.

A first circular or crown gear 40 is mounted on shaft 36 for rotation with respect thereto. A hub assembly 42 is coupled to gear 40 and is rotatable therewith about shaft 36. The hub 42 has a recess 44 formed circumferentially thereabout and receives a tab 46 therein extending upwardly from a manual tuning declutching bar 48 which itself is movable in the direction of arrows 50.

Manual tuning knob 20, shown in dotted lines in FIG. 2, is connected through a universal coupling 52 (FIG. 5) to a rotatable shaft 54 at the free end of which is provided a pinion 56 mounted in meshing engagement with circular gear 40. Through universal connector 52,
the shaft 54 is pivotal sidewise in the direction of the extension of shaft 36.

A friction clutch assembly 58 comprising discs or circular plates or halves 60, 62, is mounted on drive shaft 36. Disc half 60 is coupled to gear 40 and hub assembly 42 for rotation therewith about shaft 36, while disc half 62 is fixedly mounted on shaft 36 for rotation therewith. Disc half 62 includes a high friction material 64, such as rubber or the like, on the surface thereof mating with disc 60 to insure good engagement therebetween.

The disc halves 60, 62 and gear and hub 40, 42, respectively, are movable axially along shaft 36. The last-mentioned elements are movable as a unit and are held in the position shown in FIG. 2 normally by the de-clutching bar which is spring-biased (to the right as viewed in FIG. 2) so that the clutch plates 60, 62 are normally in engagement. Thus, manual tuning knob is likewise normally operable to turn shaft 36 and thereby to adjust the tuning slug assembly 32 to different frequency settings.

Another circular or crown gear 66 is mounted adjacent clutch plate 62 on shaft 36 for rotation therewith. A pinion 68 is mounted adjacent gear 66 on a shaft 70, connected pivotally to support wall 74, (FIG. 4) for movement into and out of engagement with gear 66. Referring to FIGS. 3, 4 and 5, a larger gear 72 is also mounted on shaft 70. The larger gear 72 is positioned adjacent support wall or plate 74 of the radio receiver and is in meshing engagement with still another gear 76 also mounted on wall 74. The latter gear is in turn engaged by another gear 78 also mounted on wall 74.

A pawl and planetary gear drive arrangement 80 including pawl member 82 operated by a solenoid 83 and planetary gear assembly 84 including sun gear 85 are interposed between gear 78 and drive motor 86 mounted on a plate 88 (FIG. 1) and used for the automatic or search tuning operation. The pawl and planetary gear arrangement provides good control of the coupling of the drive motor for initiating and stopping the search tuning drive of shaft 36. The use of the last-mentioned planetary arrangement is conventional and thus will not be described further. For a detailed description of a pawl and planetary gear arrangement similar to that shown herein, the reader's attention is directed to U.S. Pat. No. 2,834,886, issued May 13, 1958 and assigned to the same assignee as the instant invention.

The automatic tuning apparatus according to the invention for coupling the motor driven pinion 68 to crown gear 66 on shaft 36, and for decoupling manual tuning knob 20, comprises a link arrangement designated generally by the numeral 90. The link arrangement includes a generally L-shaped member 92 mounted on a shaft 94 extending from support wall 74, for pivotal movement about the shaft. A first leg 95 of the member extends outwardly, vertically from the pivot point and has an aperture 96 in the free end thereof through which the shaft 70 upon which pinion 68 is mounted is received.

The opposite leg 98 of the pivotal member 92 extends outwardly along the horizontal as shown in FIG. 4 and includes an aperture 100 therethrough. Link arrangement 90 also includes a plate 104 mounted at an end 106 for pivotal movement with respect to a support wall 108 adjoining support wall 74. A leg 102 of the plate is received in aperture 100 of arm 98 of member 92. Arms 110, 112 of the plate 104 extend through an elongated aperture 116 in support wall 108 and are bent downwardly to secure the plate thereto. A second leg 116 extends downwardly from plate 104 and has a foot portion 118 positioned in engagement with de-clutching bar 48. A horizontally extending arm 120 of plate 104 is attached to the armature 122 of a solenoid 124 by a pin 125 for pivotal movement with respect to the armature 122. The solenoid as will be explained hereinafter, is activated for automatic tuning of the radio receiver.

As seen in FIGS. 2 and 4, a spring 126 is wrapped about the shaft 94 upon which member 92 is mounted. Spring 126 biases member 92 in the direction of arrow 128 (clockwise as shown in FIG. 4) to maintain pinion 68 normally out of engagement with crown gear 66 so that drive motor 86 is not coupled to turn shaft 36.

Also mounted on shaft 36 for rotation therewith is a cam 130 (FIGS. 2 and 5). The cam is mounted adjacent and for engagement with the cam 131 of a double pole, double throw switch 132. As will be described hereinafter, the cam and switch combination controls the direction of searching during automatic tuning.

Referring now to the circuit diagram of FIG. 6, the operation of the automatic tuning apparatus according to the invention will now be described.

To initiate automatic tuning of radio receiver 10, actuator bar 30 (FIG. 1) is depressed momentarily. The operation of actuator bar 30 actuates a trigger circuit 133 to apply a voltage from B+ on lead 136 (FIG. 6) to the winding of solenoid 124. Likewise, a potential is applied to the coil of pawl arrangement 80 via lead 136. Simultaneously therewith, a relay 138 (FIGS. 2 and 6) is energized to pull in its make contacts 138a, 138b, 138c. The closing of contacts 138a completes a circuit over lead 146 and through contact 132a of the double pole, double throw switch 132 to ground 140 for drive motor 86. The motor is also connected via lead 148, through the other break contact 132c of the double pole, double throw switch to a positive voltage potential over lead 142. Also, through contacts 138b, 138c, and leads 149, 151, respectively, circuits to the pawl solenoid winding and the winding of solenoid 124, respectively, are completed to ground 140.

Upon the pulling-in of pawl 82 for engagement with sun gear 85, drive motor 86 is coupled to shaft 70 for driving the slug tuner carriage assembly. Also, upon pulling-in armature 122 of solenoid 124, plate 104 is pivoted about end 106 thereof. The pivotal movement of the plate causes, through leg 116, the movement of declutching bar 48 to the left as viewed in FIGS. 2 and 4. The movement of the declutching bar in turn moves the hub assembly 42 and gear 40 to the left, to disengage clutch disc halves 60 and 62, thereby decoupling manual tuning knob 20. While the knob continues to be rotatable manually, the rotation thereof merely serves to turn gear 40 about shaft 36 with no movement of the latter provided.

The pivotal movement of plate 104, through leg 102 thereof, causes member 92 to be pivoted against the force of spring 126 in a counterclockwise direction as shown in FIGS. 2 and 4. The pivotal movement of member 92 moves shaft 70, which is described heretofore is pivotal on plate 74, to the left, causing pinion 68 to become engaged with gear 66. Thus, the drive motor, through pinion 68 and crown gear 66, turns the
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shaft 36 to drive the tuner carriage, thereby changing the frequency setting of the radio receiver. Conventionally, a momentary actuation of bar 30 activates the drive motor for search tuning until such time as a new frequency setting is reached. At that time, the relay 138 is deenergized by trigger circuit 133, dropping out the solenoid 124 and the pawl solenoid 83. If the actuator bar is maintained depressed, the relay 138 is also maintained energized until the bar is released and thereafter until a first new frequency setting is reached.

During the automatic tuning operation, it is possible to reach an end of the frequency band. At this time, cam 130 which is rotated with shaft 36, engages the armature 131 of double pole, double throw switch 132 to move it to its alternate position; i.e., to contacts 132b, 132d, whereby the leads 146, 148 to the drive motor are reversed. The reversal of the leads reverses the direction of rotation of the motor and in turn the shaft 36, to drive the core carrying carriage in a reverse direction until the cam is rotated approximately 360° to again engage the armature 131 from the opposite side.

It should be noted that the link arrangement including the solenoid operated pivotal plate (104) and member (92), provides two functions; i.e., to decouple the manual tuning knob 20 through declutching bar 48 and to couple pinion 68 to gear 66 for the purpose of coupling drive motor 86 to shaft 36, thereby to automatically search tune the radio receiver.

Upon deenergization of relay 138, solenoid armature 122 falls back, permitting declutching bar 48 to return to its original position. At that time, clutch plate halves 60, 62 are recoupled to place manual tuning knob 20 in an operable condition. Also, spring 126 aids in pivoting member 92 to its original position, whereby pinion 96 is disengaged from gear 66.

It should be noted that upon reaching a new frequency setting, the pawl 82 of pawl arrangement 84 is disengaged from sun gear 85. The disengagement of the latter immediately decouples drive motor from gear 78 stopping the driving of shaft 36 thereby, and thus avoiding the necessity to rely on the cessation of the operation of drive motor 86, which might continue to turn after being deenergized.

Thus, the automatic tuning apparatus according to the invention provides a relatively simple and accurate means for decoupling a manual tuning knob and coupling an automatic drive motor tuning arrangement to the movable tuner carriage assembly of a radio receiver. The latter is accomplished with a minimum of parts which require a minimum of space in the chassis of a search tuning radio receiver according to the invention.

While a particular embodiment of the invention has been shown and described, it should be understood that the invention is not limited thereto since many modifications may be made. It is therefore contemplated to cover by the present application any and all such modifications as fall within the true spirit and scope of the appended claims.

1. In a search tuning radio receiver comprising tuning means including a plurality of stationary tuning coils and a plurality of tuning cores mounted for movement with respect to said coils for changing the frequency setting of said radio receiver and a rotatable drive shaft coupled mechanically to said tuning cores for altering the position thereof with respect to said coils in accordance with the rotation of said shaft, manually tuneable automatic tuning core drive means including in combination: manually operated actuator switch means, a drive motor coupled electrically to said manual actuator switch means and to a source of power for energization in response to the operation of said actuator switch means, first gear means mountable on said drive shaft for rotation therewith, second gear means for coupling said drive motor to said first gear means to drive said rotatable drive shaft rotationally, said second gear means including a rotatable shaft mounted at one end for pivotal movement and having a gear mounted on the opposite end thereof for rotation therewith, said rotatable gear shaft being coupled mechanically to said drive motor and being pivotal toward and away from said first gear means, solenoid means coupled electrically to said manual actuator switch means and said source of power for energization in response to the operation of said actuator switch means, said solenoid means including an armature movable between first and second positions in response to the energization and deenergization, respectively, thereof, link means coupled mechanically to said solenoid armature, said link means including a pivotally mounted member coupled to the rotatable gear shaft of said second gear means and movable between a first position and a second position in response to the energization and deenergization of said solenoid means, respectively, to pivot said second gear means into engagement with said first gear means, thereby to mechanically couple said drive motor to said rotatable drive shaft for changing the position of said tuning cores with respect to said coils, thereby adjusting the radio frequency setting of said radio receiver, third gear means mountable on said rotatable drive shaft for rotation thereabout and manual tuning means having a manually rotatable tuning knob and gear means coupled thereto for changing engagement with said third gear means, and clutch means coupled to said third gear means for normally maintaining the latter in driving relation with said first gear means for rotating said rotatable drive shaft thereby to manually alter the position of said tuning means in response to the rotation of said knob, and wherein said link means is coupled to said clutch means for declutching the latter in response to the energization of said solenoid means to decouple said third gear means from said first gear means thereby preventing rotation of said manual tuning knob during automatic tuning of said radio receiver and further including a declutching bar mounted for movement between first and second positions, said declutching bar being coupled to said third gear means for movement thereof from a driving to a decoupled relation with respect to said rotatable drive shaft in accordance with the movement of said declutching bar from said first to said second position, and wherein said link means further include a second member coupled to the armature of said solenoid means for pivotal movement in response to the energization of said solenoid means, said second member being positioned to move said declutching bar from said first to said second position in response to the energization of said solenoid means, thereby to decouple said manual tuning knob.

2. A radio receiver as claimed in claim 1 wherein said first-mentioned pivotally mounted link member has first and second legs, said first leg being coupled to said
movable rotatable gear shaft and the second leg being movably coupled to said second member, whereby upon energization of said solenoid means said second member is rotated about its pivot point in a first direction and said first member is rotated about its pivot point in the opposite direction, to decouple said manual tuning knob and to couple said drive motor to said rotatable drive shaft, respectively.

3. In a radio receiver having a tuner assembly including a plurality of stationary tuning coils and a plurality of tuning cores mounted for movement with respect to said coils to alter the frequency setting of said radio receiver, a rotatable drive shaft coupled to said tuning cores for moving the latter in accordance with the rotation of said drive shaft, said drive shaft carrying first gear means mounted for rotation therewith, clutch means having a first clutch plate connected to and rotatable with said first gear means and a second clutch plate engaging said first clutch plate in a first position for rotation in accordance therewith and movable to a second position axially along said drive shaft separated from said first clutch plate so as to remain stationary when said drive shaft is rotated, second gear means coupled to said second clutch plate, said second gear means being rotatable and movable with said second clutch plate and manual tuning means including a rotatable tuning knob and gear means coupled to said second gear means for manually rotating said drive shaft when said second clutch plate is in said first position, means for automatically tuning said radio receiver including in combination: drive motor means, third gear means including rotatable shaft means mounted for pivotal movement at one end thereof and having a gear member mounted on the opposite end thereof, said shaft means being coupled to said drive motor means for rotation thereby and positioned for pivotal movement to move said gear member into and out of engagement with said first gear means for coupling and decoupling said drive motor means thereto, respectively, to drive said rotatable drive shaft, solenoid means including an armature movable from a first to a second position in response to the energization of said solenoid means from an unoperated condition to an operated condition and vice versa in response to the deenergization thereof, actuator switch means coupled electrically to a source of electrical potential and to said solenoid means for energizing said solenoid means from said unoperated to said second operated condition, said switch actuator means also being coupled electrically to said drive motor for energizing said drive motor simultaneously with said solenoid means, and link means coupled to the armature of said solenoid means for movement between a first and second position in response to the energization and deenergization of said solenoid means, respectively, said link means also being coupled to said second and third gear means, said second gear means being moved thereby axially along said drive shaft to separate said clutch plates so as to decouple said manual tuning knob from said first gear means, and said third gear means being moved into engagement with said first gear means in response to the operation of said actuator switch to energize said solenoid means causing said drive shaft to be driven rotatably by said drive motor means to move said tuning cores with respect to said stationary tuning coils for automatic tuning of said radio receiver, and wherein said link means include a pivotally mounted member mov-

able in response to actuation of said solenoid means from a first to a second position to move said third gear means into and out of engagement with said first gear means, said pivotally mounted member being resiliently biased toward said first position, whereby upon deactuation of said solenoid means said link member is returned to said first position, thereby disengaging said first and third gear means.

4. A radio receiver as claimed in claim 3 further including declutching means coupled to said clutch plate for separating said first and second clutch plates and wherein said link means further include a second pivotally mounted member joined for movement with said first member, and connected to said solenoid means, said second member being positioned in engagement with said declutching means for movement thereof in a first direction in response to the actuation of said solenoid means to separate said clutch plates, said declutching means being biased to return said clutch plates to an engaged condition upon the deactuation of said solenoid means.

5. A radio receiver as claimed in claim 4 wherein said first link member includes first and second legs and is pivotal about a point located between said legs, said first leg coupled to said third gear means for movement thereof into and out of engagement with said first gear means in response to the actuation and deactuation of said solenoid means, respectively, said second leg being joined with said second pivotal link member, said second link member being connected to said solenoid means for pivotal movement in response to the actuation of the latter, whereby said first link member is pivoted also, said second link member having an arm portion extending therefrom for engagement with said declutching means for decoupling said manual tuning knob.

6. In a radio receiver having a tuner assembly including a plurality of stationary tuning coils and a plurality of tuning cores mounted for movement with respect to said coils to alter the frequency setting of said radio receiver, a rotatable drive shaft coupled to said tuning cores for moving the latter in accordance with the rotation of said drive shaft, said drive shaft carrying first gear means mounted for rotation therewith, clutch means having a first clutch plate connected to and rotatable with said first gear means and a second clutch plate engaging said first clutch plate in a first position for rotation in accordance therewith and movable to a second position axially along said drive shaft separated from said first clutch plate so as to remain stationary when said drive shaft is rotated, second gear means coupled to said second clutch plate, said second gear means being rotatable and movable with said second clutch plate and manually tuning means including a rotatable tuning knob and gear means coupled to said second gear means for manually rotating said drive shaft when said second clutch plate is in said first position, means for automatically tuning said radio receiver including in combination: drive motor means, third gear means including rotatable shaft means mounted for pivotal movement at one end thereof and having a gear member mounted on the opposite end thereof, said shaft means being coupled to said drive motor means for rotation thereby and positioned for pivotal movement to move said gear member into and out of engagement with said first gear means for coupling and decoupling said drive motor means thereto, respec-
tively, to drive said rotatable drive shaft, solenoid means including an armature movable from a first to a second position in response to the energization of said solenoid means from an unoperated condition to an operated condition and vice versa in response to the deenergization thereof, actuator switch means coupled electrically to a source of electrical potential and to said solenoid means for energizing said solenoid means from said first unoperated to said second operated condition, said switch actuator means also being coupled electrically to said drive motor for energizing said drive motor simultaneously with said solenoid means, and link means coupled to the armature of said solenoid means for movement between a first and second position in response to the energization and deenergization of said solenoid means, respectively, said link means also being coupled to said second and third gear means, said second gear means being moved thereby axially along said drive shaft to separate said clutch plates so as to decouple said manual tuning knob from said first gear means, and said third gear means being moved into engagement with said first gear means in response to the operation of said actuator switch means to energize said solenoid means causing said drive shaft to be driven rotatably by said drive motor means to move said tuning cores with respect to said stationary tuning coils for automatic tuning of said radio receiver and further including switch means interposed electrically between said drive motor means and said actuator switch means, said switch means being operable to a first and second condition for changing the polarity of the operating potential provided to said drive motor for reversing the direction of rotation of said rotatable drive shaft in accordance with the condition of said switch means, said switch means including an armature movable between first and second positions to change the condition of said switch means, and a cam member mounted on said rotatable drive shaft means for rotation therewith, said cam member extending outwardly for engagement with said armature after said rotatable drive shaft is rotated a predetermined number of degrees, thereby to change the position of said armature to reverse the direction of rotation of said rotatable drive shaft.