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TUNING MECHANISM

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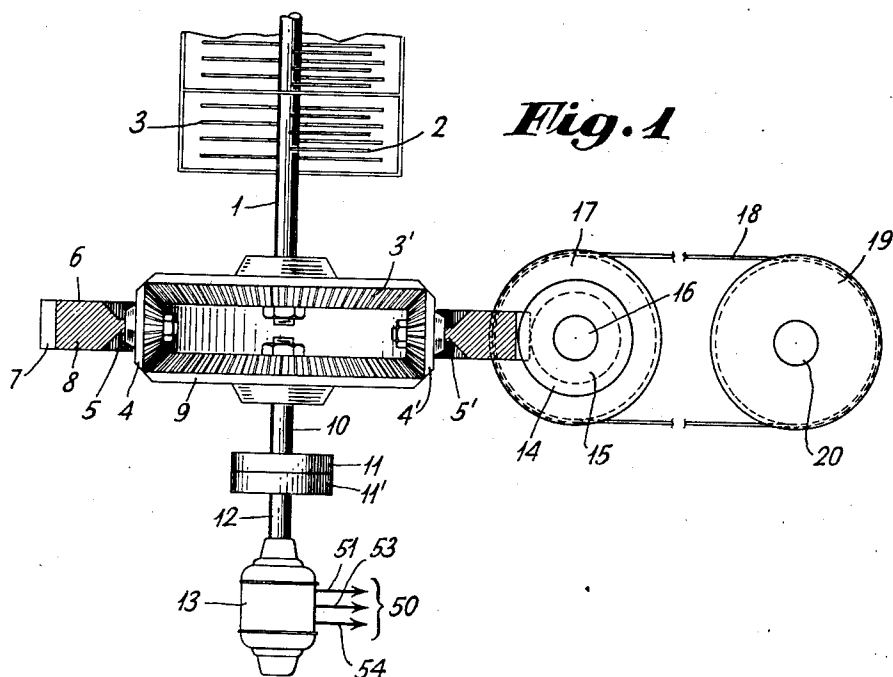


Fig. 1

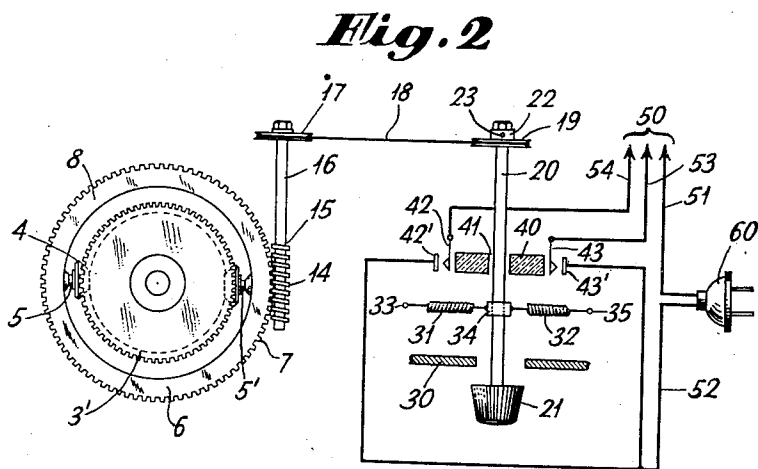


Fig. 2

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TUNING MECHANISM

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My present invention relates to tuning mechanisms for radio receivers, and more particularly to devices for facilitating coarse and fine adjustment of the tuning mechanism of a radio receiver.

As is well known, it is necessary in radio receivers to provide a means for rotating the rotors of the variable tuning condenser. It is customary to provide a manually adjustable tuning instrumentality, such as a knob, projecting from the panel of the receiver cabinet. The knob is mechanically coupled to the condenser rotor shaft so that rotation of the knob produces a corresponding rotation of the rotors and consequent adjustment of the tuning condenser capacity. Furthermore, it is desirable that there be a change in ratio of rotation of the knob with respect to the variable condenser rotors. A rapid rotation of the rotors is desirable when tuning from one station to another through the tuning spectrum; and a very slow rate of rotation of the rotors is desired when tuning exactly to the center, or carrier, frequency of a station.

In the past, this change in ratio of rotation of the tuning knob with respect to the rotors has been accomplished by a double mechanical system, the knob being shifted to interlock the mechanical system with the desired ratio. However, such a mechanical system has a number of technical disadvantages. The rough mechanical action in shifting from one ratio to another does not feel right in the operation of a delicate mechanism such as a radio receiver. In tuning from one station to another, the mechanical ratio device must always be shifted first to the high ratio position, the condenser rotor being rotated to about the correct position; the ratio device is then shifted back to a low ratio position and the final tuning is done.

Accordingly, it may be stated that it is one of the main objects of my present invention to provide a plurality of means for individually controlling a variable element of an electrical instrumentality; a common actuating member being employed for the individual controlling means; and the individual controlling means being so inter-related with the common actuating means that both may act simultaneously on the variable element, yet be substantially independent in action.

Another important object of the invention may be stated to reside in the provision of a coarse and fine tuning adjustment device for the variable tuning condenser of a radio receiver; the device being constructed and arranged for producing

coarse adjustment of the condenser rotors when the tuning device is adjusted in one manner, and the rotors being adapted for fine adjustment when the tuning device is adjusted in a different manner.

Still more specific objects of the invention comprise the utilization of a motor circuit for coarse adjustment of the rotors of the tuning condenser of a radio receiver, and a manually adjustable device for fine adjustment of the rotors; a common actuating mechanism being employed for energizing the motor circuit and making the fine adjustments of the rotors.

Other objects of my invention are to improve generally the efficiency of tuning mechanisms of a radio receiver, and more especially to provide tuning mechanisms adapted for coarse and fine tuning adjustment, and which mechanisms are not only reliable in operation but are economically manufactured and assembled in radio receivers.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims; the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated diagrammatically a circuit organization whereby my invention may be carried into effect.

In the drawing:

Fig. 1 shows one embodiment of the invention, certain elements being shown in section.

Fig. 2 is a plan view of the gear mechanism shown in Fig. 1, with the actuating circuit elements embodied.

Referring now to the accompanying drawing, wherein like reference characters in the different figures illustrate similar elements, there is shown in Fig. 1 a variable tuning condenser of a radio receiver. The condenser comprises the usual rotor shaft 1 which carries a plurality of rotor blades 2, the rotor blades being interleaved with spaced stator plates 3. The shaft 1 has fixedly secured to one end a bevel gear 3'; any desired type of securing means being employed to fix the gear to the end of the shaft 1. The teeth of the bevel gear 3' are adapted to be driven by the idler bevel gears 4 and 4'. These bevel gears are loosely mounted upon studs 5 and 5'; the latter being integral with the peripheral portion of the ring gear 6.

The ring gear 6 may be of any well known construction, and it will be noted that the gear is provided with vertical peripheral teeth 7 and

a substantially thick peripheral portion 8. The studs 5 and 5' may be cast integrally with the peripheral portion 8, or they may be secured thereto in any desired manner. These studs 5 and 5' are in alignment, and their inner ends are provided with the bevel idler gears 4 and 4'. Those skilled in the art will be fully aware of the manner of mounting the gears 4 and 4' so that they remain in loosely coupled relation with the ends of the studs 5 and 5'. More than two idler gears can be used, if desired.

The idler gears 4 and 4' are in turn adapted to be rotated by the bevel gear 9, the latter being rigidly secured to one end of the shaft 10. The opposite end of the shaft 10 is provided with one of a pair of slip clutch discs 11, the other of the discs 11' being rigidly secured to the motor driven shaft 12. The discs 11-11' have leather facings. A motor 13 is provided for rotating the shaft 12, and thereby rotating the driven bevel gear 9 through the frictional contact between clutch discs 11 and 11'. The clutch discs 11 and 11' may be of any well known construction; it being only necessary to point out that these discs should provide sufficient frictional contact therebetween to rotate the gear 9 when the electric motor 13 is energized. This clutch is needed only if a positive mechanical stop is used on the condenser rotor. Then at the end of the rotation the clutch will slip and no harm will be done. If the condenser rotor can continuously rotate, this clutch may be omitted.

The peripheral teeth 7 of the ring gear mesh with the teeth 14 of the worm gear 15. The worm gear 15 is provided at one end of a shaft 16; the opposite end being provided with a pulley 17 which is fixedly secured thereto. The pulley 17 is adapted to be driven by the flexible belt 18, and the latter is actuated by rotation of the pulley 19. As shown in Fig. 2, the pulley 19 is mounted near one end of the shaft 20, the opposite end of the latter having fixedly secured thereto the manually adjustable knob 21. The shaft 20 passes through a sleeve 22 positioned as shown, so that the shaft is free to rotate within the sleeve. The sleeve is provided with means 23 adapted to pivot the sleeve, with the result that the shaft 20 may be rocked or oscillated about the pivot point 23.

It is not believed necessary to show the bearings for the pivot member element 23, since those skilled in the art will clearly understand that sleeve 22 is constructed so as to be pivoted about a vertical axis upon angular movement of knob 21 in the plane of the drawing; whereas a rotatable movement of knob 21 results in adjustment of shaft 20 and the pulley 19 secured to the shaft. Accordingly, it will be seen that when the knob 21 is rotated in clockwise, or counter-clockwise, direction, the pulley 19 will be rotated, and hence rotate the ring gear 6 through the agency of belt 18, pulley 17 and worm gear 15. When the ring gear 6 rotates, it will carry the idler gears 4 and 4' around with it. When the motor 13 is not running the bevel gear 9 will be stationary. This means that the idler gears 4 and 4' will roll over the face of the bevel gear 9, meshing with the teeth thereof. By virtue of such rolling motion over the bevel gear 9, the bevel gear 3' will be rotated and thus vary the position of the rotor shaft 1.

Referring more specifically now to Fig. 2, wherein there is shown the actuating mechanism for the electric motor 13, it will be understood that the tuning knob 21 protrudes beyond the

operating panel, shown in a fragmentary manner by the numeral 30. To maintain the knob shaft 20 in its proper initial position, there are provided opposing springs 31 and 32. The spring 31 has one end thereof fixedly secured to a point 33, its opposite end being fixedly secured to a point on the slip ring 34.

The spring 32 has one end thereof secured at point 35; the opposite end being secured to ring 34 at a point diametrically opposite to the point thereon to which spring 31 is affixed. An insulation block 40 is provided on the shaft 20; the block may have a square configuration and a central circular aperture 41 through which is passed the shaft 20. The block 40 is actuated upon lateral adjustment of the knob 21; however, rotation of the knob causes the shaft 20 to rotate freely in the bore 41. The block 40 cannot rotate upon rotation of knob 21, because opposed edges of the block abut the spring switch elements 42 and 43. The switch element 42 has a fixed contact member 42' associated therewith; the fixed contact member 43' is associated with spring element 43.

It will now be seen that lateral adjustment of knob 21 closes either switch 42-42' or switch 43-43'. The elements 42 and 43 are preferably constructed so as to prevent angular motion of the block closing the switches, while permitting lateral motion of the block to close the switches. The switches have the elements thereof connected to leads 50 which connect the motor to the energizing current source.

The latter may be a part of the radio receiver current supply circuit; or it may be the usual plug connection to the lighting means. Assuming the latter is employed, the numeral 60 denotes such a plug device; one prong of the plug being connected by lead 51 to a terminal of the motor 13. Lead 52 connects the other prong of plug 60 to contacts 42' and 43'. Lead 53 connects spring switch element 43 to the middle terminal of motor 13; and lead 54 connects the remaining terminal of the motor to switch element 42. The numeral 50 denotes the group of wires connected between the motor terminals and the switches.

The motor 13 is of the reversible type; closure of switch 42-42' causes the motor 13 to rotate shaft 1 in one sense, while closing of switch 43-43' causes motor 13 to rotate shaft 1 in the opposite sense. Assuming, now, that knob 21 has been laterally shifted to the left; block 40 closes switch 42-42' and completes the motor circuit through path 51-54-52. The motor is energized, and rotates gear 9 by virtue of the clutch discs 11-11'. Motion of gear 9 causes the idler gears 4-4' freely to rotate upon the studs 5-5'; the bevel gear 3' thereby is caused to rotate. Since the ring gear 6 is held immobile by virtue of its teeth 7 meshing with the teeth 14 of worm gear 15, the ring gear functions as a support for the idler gears 4-4'. If the motor rotates the gear 9 to the left, for example, the gear 3 will be rotated to the right.

In actual usage, the knob 21 will usually be laterally shifted to cause the shaft 1 to be rotated clockwise or counter-clockwise. If the receiver is tuned to a station whose carrier frequency is located at one end of the tuning range and it is desired to tune to a station at the other end of the range, the knob 21 will be shifted towards that switch which causes the motor 13 to rotate rotor shaft 1 in the correct tuning direction. When the operator observes that the station is

roughly brought in (as by listening to the loudspeaker, or watching a visual tuning indicator), he will restore shaft 20 to its neutral position and rotate knob 21. Of course, springs 31 and 32 are opposingly tensioned to keep shaft 20 in its normal, neutral position; the elements 42 and 43 can be leaf springs which move out of contact with members 42' and 43' when block 40 is in neutral position. It is, also, possible to make the spring switch elements 42 and 43 serve to act in place of springs 31 and 32, thus not requiring the use of springs 31 and 32.

When the knob 21 is rotated for fine adjustment of the rotors 2, the latter are adjusted by virtue of the rotation of the ring gear 6. As explained before, rotation of knob 21 causes the shaft 20 to rotate within sleeve 22 thereby driving pulley 17 through the agency of belt 18. When the worm gear 14 rotates the ring gear 6 causes the idler gears 4 and 4' to roll over the periphery of bevel gear 9. This rolling action results in rotation of the gear 3'. The knob 21 will be adjusted by the operator of the set, after sufficient coarse adjustment through motor 13 has been secured; to the point where the rotors 2 have been adjusted accurately to bring in the desired station carrier. Of course, the operator can use his ear to tell him when the desired carrier frequency has been reached; or he can use a visual tuning indicator for this purpose.

With the pivot for the out-of-line movement of the drive shaft 20 located very close to the center of the pulley 19, this movement does not change the belt tension. Hence, the condenser rotors can be rotated by rotation of the knob 21, even though the switch 42-42' or the switch 43-43' is held closed by lateral pressure of block 40. Therefore, the mechanical and electrical drive of the condenser rotors may be accomplished simultaneously or independently. In case both the motor 13 is running, and the shaft 20 is simultaneously being rotated, the condenser rotors 2 rotate as the sum or difference of the two effects, depending on the initial directions of rotation.

While I have indicated and described a system for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organization shown and described, but that many modifications may be made without departing from the scope of my invention, as set forth in the appended claims.

What I claim is:

1. In control mechanism for operating the adjustable tuning element of a radio receiver, a motor and driving means interconnected between the motor and the tuning element, a pair of spaced-apart switches included in the motor energizing circuit for selectively controlling the operation of said motor and driving means in one direction or the other, additional driving means coupled to the tuning element, and a single manual control member capable of rotary and lateral movements and having rotary means in coupled relation with said additional driving means and slidable means interposed between the motor

switches, the arrangement being such that rotation of the manual control member causes adjustment of the tuning element through the additional driving means and lateral movement of said control member in one direction or the other from a neutral position causes adjustment of the tuning element through the motor and the driving means connected thereto.

2. In control mechanism for operating the adjustable tuning element of a radio receiver, means for providing both coarse and fine adjustments of said tuning element, said adjusting means comprising a single actuator, driving means interconnected between the actuator and the tuning element, a motor and an energizing circuit therefore, second driving means interconnected between the motor and the tuning element, switch mechanism for the motor energizing circuit disposed adjacent the single actuator, the arrangement being such that rotary motion of the single actuator will operate the first driving means to provide the fine adjustment of the tuning element and lateral motion of the actuator will actuate the switch mechanism to operate the motor and the second driving means to provide the coarse adjustment.

3. In control mechanism for operating the adjustable tuning condenser of a radio receiver, means for providing both coarse and fine adjustments of said tuning condenser, said adjusting means comprising a motor the shaft of which is in alignment with that of the tuning condenser, a pair of bevel gears affixed to the adjacent ends of said shafts, a pair of smaller bevel gears meshing with said first mentioned bevel gears, a ring gear having means on its inner periphery for rotatably mounting said smaller bevel gears, a shaft carrying at one end a worm gear meshing with the ring gear, a pulley carried at the other end of said shaft, a manually operated shaft journaled in a bearing which permits rotary movement of the shaft as well as swinging movement thereof about the bearing as a center, a pulley affixed to the manually operated shaft adjacent its bearing, a cable entraining about said pulleys, a pair of spaced-apart switches included in the motor energizing circuit for selectively controlling the operation of said motor in either direction, and means responsive to swinging movement of the manually operated shaft in one direction or the other from a neutral position for actuating one or the other of said pair of switches rotation of the manually operated shaft in its neutral position causing fine adjustment of the tuning condenser by reason of the motion being transmitted from the shaft to the pulleys and cable, worm gear, ring gear, the small bevel gears and the bevel gear mounted on the condenser shaft, and swinging movement of the manually operated shaft in either direction from its neutral position causing coarse adjustment of the tuning condenser by reason of the rotation of the motor shaft, the bevel gear mounted thereon, the small bevel gears now acting as idlers, and the bevel gear mounted on the condenser shaft.

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