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TUNING SYSTEM

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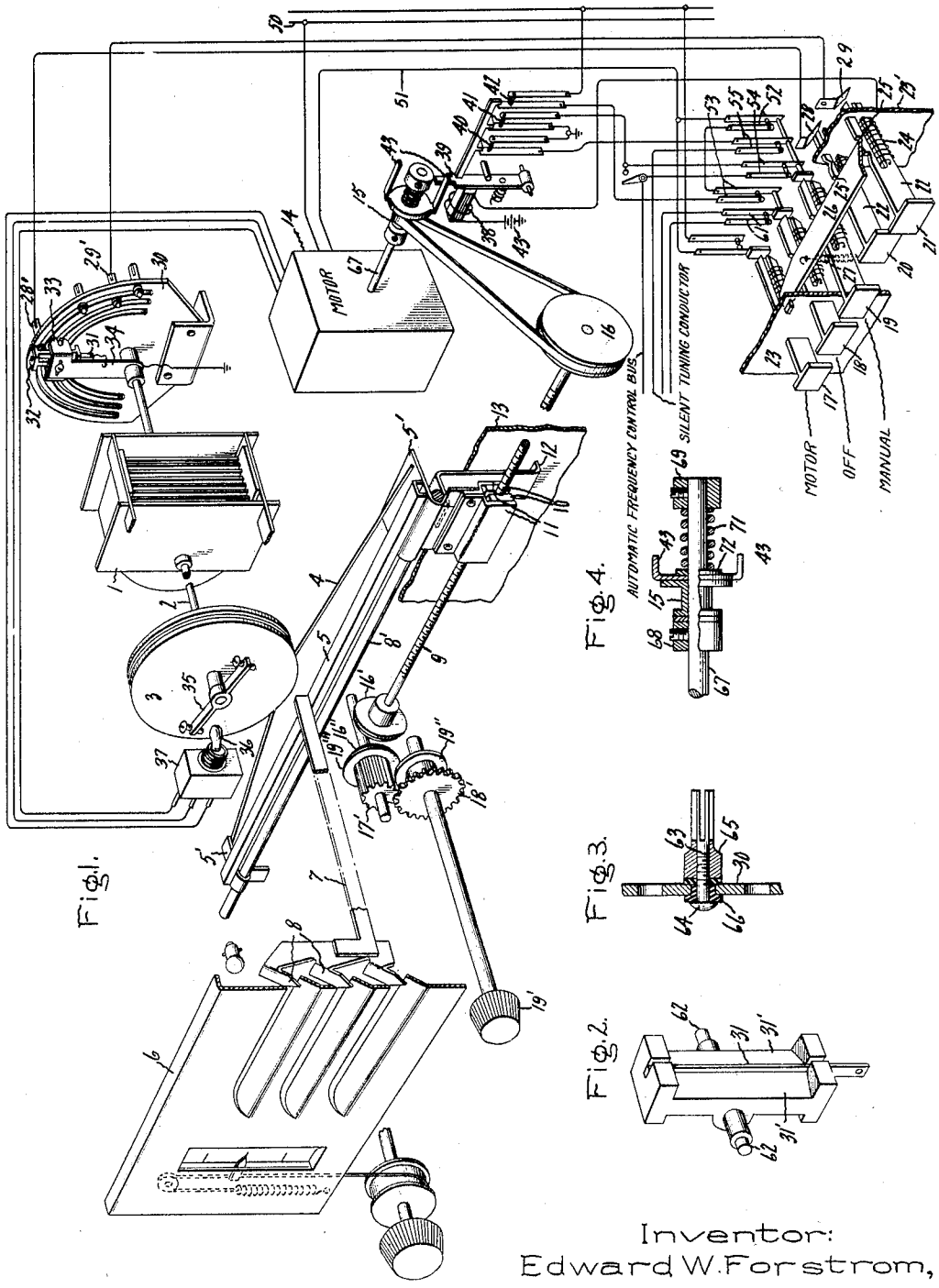

Fig. 1.

Fig. 4.

Fig. 3.

Fig. 2.

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TUNING SYSTEM

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4 Claims. (Cl. 250—40)

My invention relates to tuning systems for high frequency receivers and more particularly to drive means therefor. It has for one of its objects to provide certain improvements in mechanical arangements for driving the tuning devices and tuning indices, of such receivers.

While my invention is not limited thereto, it pertains more particularly to such arrangements in which the tuning device is driven by a motor and it has for one of its objects to provide a driving arrangement of economical and yet sturdy construction which may be readily incorporated into radio receivers and which is well adapted for cooperation with dials having longitudinal scales. A further object of my invention is to provide such means which are motor driven and which, at the same time, are well-adapted to be driven by hand.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken with the accompanying drawing, in which Fig. 1 represents an embodiment of my invention and Figs. 2, 3, and 4 represent details thereof.

Referring to Fig. 1 of the drawing, I have shown therein a tuning element 1 of a high frequency receiver such, for example, as is commonly employed for radio reception. This element, in the form shown in the drawing, may be the ordinary tuning condenser, or assembly of tuning condensers, of such receivers. The rotor of this condenser is mounted upon a shaft 2, which is provided with a pulley 3. The pulley 3 is driven by means of a cable 4, the opposite ends of which are attached to the respective ends of a somewhat elongated carriage, or rider 5. The carriage 5 is arranged for longitudinal movement behind the panel of the radio receiver, upon which may be mounted a dial 6, and it is provided with an index carrying arm 7 having a number of pointers, or indices 8 arranged thereon to cooperate with the scales which are provided upon the dial.

To provide for this longitudinal reciprocation of the rider 5, it is arranged to slide upon a rail 8, beneath and parallel with which, is mounted a screw 9. This screw is provided with a split nut 10, which is clamped between two members 11 attached to the rider 5. These members 11 have a certain resilience tending to bear the opposite members of the split nut firmly against the screw. Thus as the screw is rotated, the split nut travels along it, causing the rider 5 to slide along the rail 8.

It will be noticed that the rider 5 comprises, at its right end, a strip of metal 5', which is bent around the rail and turned downward, the lower end being bent backward to form a foot 2. The back edge of this foot bears against a member 13, only a fragment of which is shown, but which may comprise the chassis of the radio receiver. A similar member 5' may, of course, be provided at the opposite end of the rider, but this member, for simplicity of the drawing, is not shown in full.

These members 5' are connected together by one or more longitudinal members to form the rider 5. In the form of the invention shown in the drawing, the screw 9 is arranged to be driven by means of a motor 14, the shaft of which is provided with a pulley 15, which, in turn, is belted to a pulley 16, mounted upon the screw 9.

It is also arranged to be driven by means of a bevel gear 16' mounted on the opposite end of the screw the latter of which cooperates with, but is normally disengaged from bevel gear 16''. This latter gear is preferably integral with a somewhat elongated toothed gear 17' which cooperates with a gear 18' mounted on the shaft of knob 19'. The shaft of knob 19' is also provided with a disk 19'' which, when the knob is pressed inwardly by the operator, engages the shoulder 19''' formed on bevel gear 16'' and presses that gear into engagement with bevel gear 16'. Upon rotation of the knob the bevel gears are now driven due to the meshing of gears 17' and 18' thereby rotating the screw and driving the carriage or rider 5. Upon release of the knob, rotation of the screw by the motor causes the bevel gears to disengage.

In practice the bevel gear 16' may suitably comprise a conical leather surface and the gear 16'' may comprise a die cast member having a conical knurled surface to cooperate therewith.

The motor 14 is connected to be controlled by a number of switches which are operated by means of a number of push buttons or keys, five of which, 17, 18, 19, 20, and 21 are shown on the drawing. The push buttons 17, 18, and 19 are provided for purposes, later to be indicated and bear appropriate legends "Motor", "Off", and "Manual" on the drawing. Push buttons 20 and 21, and others, which may be incorporated in the same assembly, are provided to effect selective tuning of the receiver to desired frequencies, and may, if desired, bear legends corresponding

to stations operating on those frequencies. That is, each of these buttons 20, 21 and so forth corresponds to a particular broadcasting station, the connections being such that in response to operation of any of these buttons, the receiver is automatically tuned to the frequency at which the desired station operates.

These buttons are all of similar construction, comprising strips of metal 22 mounted within slots in two parallel members 23 and 23'. The back ends of these members 22 are bifurcated, one leg of the bifurcated portion being provided with a spring 24, one end of which bears against members 23' and the other end of which is attached to, or bears against, the key, whereby the spring tends to bias the key to the normal, or left hand position, as shown on the drawing.

The upper side of each key, with the exception of the "Motor" key 17, is provided with a pair of notches, which cooperate with a locking member 26, one edge of which is supported by member 23 and the other edge of which is biased downwardly by means of a spring 27. With all of the keys in the position shown in the drawing, this locking member engages the right hand notch 25 of keys 18, 19 and 21 and the left hand notch 25 of key 20, the latter key having been pressed inward, in which position it is locked by member 26 engaging the left hand notch 25. If key 21 be now pressed inwardly, or any of the other keys except key 17, the locking member 26 is raised as it rides from one notch of key 21 to the other, and, when it is in its raised position, key 20 is released. It will thus be seen that any of the keys, except key 17, when operated, is locked in its operated position but is returned to the normal position when any other key is operated. Key 17, however, when operated returns to the normal position upon being released by the operator, and its operation does not release the other keys.

Keys 20 and 21 and the other keys corresponding to frequencies to be selected, when in their inner position, engage contacts 28, 29, etc. respectively. These contacts are connected to stationary contacts 28' and 29', respectively, of a commutator arrangement, the movable contact carrying arm 34 of which is mounted upon the condenser shaft. This commutator comprises a plate having a plurality of semi-circular, concentric slots in which the various contacts 28', 29' are mounted. The movable contact comprises a conducting member, the lower portion of which is indicated at 31. This contact is carried by a non-conducting member 32, pivotally supported between two ears 33 of the arm 34 mounted upon the condenser shaft whereby, as the condenser rotates, the arm swings over the commutator and its contact 31 engages the different contacts 28', and 29' mounted in the slots of the plate 30.

The contacts 28', and 29' etc. are positioned in the slots at positions such that, when engaged by the movable contact 31, the receiver is in accurate resonance at the frequency corresponding to the key operated. Since these frequencies may be comparatively close together in the frequency spectrum, the corresponding contacts, may necessarily be in closely spaced angular positions about the shaft of the condenser. For this reason the plurality of slots is provided and the contacts positioned in the different slots so that they may be placed in close, angular position, even though the contacts and the securing means therefore may be relatively large.

The opposite end of the shaft of the condenser is provided with a pair of oppositely extending arms 35 which, at the limits of their movement, engage the movable element 36 of a reversing switch 37. This switch is connected in the field circuit of the motor 14, the connections being such that when the motor is operated, it drives the screw 9, and, hence, the tuning condenser, until one or the other of the arms 35 engages the reversing switch element 36. When this occurs, the switch reverses the field excitation on the motor, thereby causing the motor to reverse its direction of rotation. The motor then drives the condenser in the opposite direction until the opposite arm 35 engages the element 36, thereby again reversing the direction of rotation of the motor.

To select the different desired stations, in response to operation of keys 20, 21, etc., means are provided to stop the condenser, when the contact 31 engages the stationary contact 28', 29', etc., corresponding to the station selected. This means comprises a relay 38 having an armature 39, which operates a plurality of contacts 40, 41, and 42, and which, when in its attracted position, extends into the path of movement of ears 43 on the pulley 15, which is mounted on the motor shaft. These ears thus engage the armature 39 which causes the stopping of the pulley 15.

The winding of this relay is connected in circuit with the operated push button, or key, and with the corresponding contact of the commutator 30. This circuit extends from ground, which may be the chassis of the radio receiver, through a suitable source of operating potential 43, winding of the relay 38, member 23' of the key assembly, operated key, as, for example, key 20 as shown on the drawing, contact 28, 29, etc. of the operated key, stationary contact 28', 29' of the commutator, movable contact 31 and thence to ground.

Relay 38, by means of its contacts 42, also controls the circuit of the motor, this circuit, extending from one side of a suitable source of operating potential represented by conductors 50, thence through the motor, conductor 51, contacts 52 of key 19, contacts 53 of key 18, and thence through contacts 42 to the other side of the source. One of the contacts 41 of the relay is connected to ground, the other of these contacts being connected through contacts 54 of key 19 to the automatic frequency control bus of the receiver. This automatic frequency control bus is the conductor of the receiver which is utilized to supply control potential to the automatic frequency control means of the oscillator. When this conductor is grounded, the automatic frequency control means is, of course, disabled. One of the contacts 40 of the relay is also grounded, the other of these contacts being connected through contacts 55 of key 19 to the silent tuning conductor of the receiver. This conductor may be connected, for example, to the grid of one of the first audio stages, thereby to disable, or short circuit this stage and to silence the receiver when the conductor is grounded.

The apparatus, as shown in the drawing, is in position to tune the receiver to the frequency corresponding to button 20, this button being shown in its operated position. The circuit of the relay previously traced is closed through the stationary contacts 28 and 28'. The relay armature is therefore attracted and at its contact 42 deenergizes the motor, at its contacts 41 disconnects the automatic frequency control conductor

from ground, thereby permitting the automatic frequency control device to function normally, and at contacts 40 removes the ground connection from the silent tuning conductor of the receiver. Since its armature 39 is engaged by one of the ears 43 of the pulley 15, the condenser is stopped in the position corresponding to the desired frequency. The receiver is therefore in condition for reception of signals on the carrier frequency corresponding to key 20.

Were it now desired to tune the receiver to a different frequency, as, for example, the frequency to which key 21 corresponds, this key may be operated to its inner position. In passing to its inner position push button 21 raises locking member 26, thereby releasing button 20, which, in turn, opens the circuit of relay 38 at contact 28. This relay becomes deenergized and its armature moves to the right, thereby permitting the pulley 15 again to be driven by the motor. At its contacts 42 the relay closes the motor circuit, thereby causing the motor to start its rotation. At its contacts 41 it grounds the automatic frequency control conductor and at its contacts 40, it grounds the silent tuning conductor, thus silencing the receiver. The motor now continues to drive the condenser until contact 31 engages contact 29', which, in turn, again energizes relay 38. This relay now again stops the condenser and opens its contacts 40, 41 and 42. The receiver now operates normally at the new frequency.

It is frequently desirable to tune the receiver by hand, that is, by operating the tuning control knob 19'. This may occur when it is desired to tune the receiver to a frequency for which no key 20, 21 is provided. This may be effected by pressing push button 19 which bears the legend "Manual". Pressing this button, of course, releases any other button which may previously have been pressed and opens the circuit of the motor at contacts 52. At contacts 55 it opens the silent tuning conductor, thus permitting normal response from the output of the receiver. At contact 54 it opens the connection of the automatic frequency control bus to ground. The receiver is now in condition to be tuned manually as by means of knob 19'.

It may happen, however, that the index 8 at the beginning of manual operation, is at one end of the scale, whereas the position corresponding to the frequency of the desired station is at the opposite end of the scale. Accordingly, the operator may desire the assistance of the motor in tuning the condenser over this wide range. This he may obtain by pressing button 17, which bears the legend "Motor". The sole function of this button is to close the motor circuit only during the time when the button is pressed. Accordingly by pressing this "Motor" button, the motor is energized and the tuning condenser driven thereby until the index reaches the position on the dial, approximately corresponding to the desired frequency. The operator may then release the "Motor" button and complete the tuning operation by rotation of the knob 19'.

When it is desired to turn the receiver off, the operator presses the "Off" button 18. This key, when pressed, remains locked in its inner position and, by means of its contacts 53, opens the motor circuit. Similarly, by means of its contacts 61, it opens the energizing circuit of the receiver.

Fig. 2 shows in detail the member 32. It will be seen that it comprises a pair of arbors 62 which may be pivoted in the ears 33 of the arm 34. This member which is of non-conducting material, has a longitudinal slot in which the contact 31 is mounted, the member 32 having surfaces 31' inclined away from the edge of member 31, so that, when the member approaches a stationary contact of the commutator, these surfaces are first engaged, thereby causing the contact 31 to ride smoothly upon the rounded end surface of the stationary contact. If the stationary contact be mounted in a slot above or below the pivot of the member 32, the member 32 rocks about its pivot correspondingly. This action tends to aid in the smooth and noiseless operation of the movable contact over the various stationary contacts while at the same time assuring good electrical conduction between the engaged contacts.

Fig. 3 is a detail showing a sectional view of plate 30 through one of the stationary contacts. It will be seen that these contacts comprise a screw-threaded member 63 having a head 64, which forms the contact. This member 63 engages a screw-threaded bore in a cooperating member or shank 65, a rubber bushing 66 being clamped between the head 64 and the shank and within the slot, thereby to insulate the contact from plate 30.

With the equipment as thus far described, a considerable stress would be placed upon the armature 39 of relay 38 each time that the tuning condenser is stopped by engagement of ears 43 with armature 39. This is undesirable and to avoid it, a suitable slip clutch, or brake, is provided, this mechanism being shown in detail in Fig. 4.

Fig. 4 shows the shaft 67 of the motor on which the pulley 15 is mounted. This pulley is secured between two collars 68 and 69 on the shaft by means of spring pressure exerted by spring 71. The pulley is attached to a disk 72 which, in turn, is provided with the ears 43, these members being free to rotate about the shaft. It will thus be seen that, when member 72 stops rotation by reason of an ear 43 engaging the armature 39, the shaft 67 may continue to rotate by reason of the inertia of the motor armature. This inertia of the armature is consumed in friction between the collar 68 and the left end of the pulley.

While I have shown a particular embodiment of my invention, it will, of course, be understood that I do not wish to be limited thereto, since many modifications in the circuit and mechanical arrangements shown may be made and I contemplate, by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a tuning system including a tuning device adapted to be adjusted to a plurality of positions, a dial, an index cooperating with said dial, and a motor, a pulley connected to said tuning device, a reciprocating carriage, a belt connecting the carriage and pulley, means to mount said index on said carriage, a screw, a screw-threaded member connected with said carriage and cooperating with said screw, means to drive said screw by said motor to adjust selectively and automatically said tuning device to certain predetermined positions, means to deenergize said motor, and manual means to drive said screw to adjust said tuning device to other predetermined positions, said manual means comprising a control shaft, a driven member connected to said screw, and a

driving member operatively associated with said control shaft and adapted to be rotated thereby and to be pressed thereby into engagement with said driven member.

2. In a tuning system including a tuning device adapted to be adjusted to a plurality of predetermined positions, a dial having a longitudinal scale, as index cooperating with said dial and adapted to be adjusted correspondingly with said tuning device, a screw parallel with said dial, a rider cooperating with said screw, means to mount said index on said rider, a pulley connected to said tuning device, a cable passing over said pulley and connected at its opposite extremities respectively to the corresponding opposite extremities of said rider, a motor to drive said crew and thereby to adjust said tuning device, means operatively associated with said tuning device to reverse the direction of rotation of said motor when said index attains either end of said dial, means to deenergize said motor when said index and said tuning device arrive at certain of said predetermined positions, and manual means to rotate said screw thereby to adjust said index and said tuning device to others of said predetermined positions.

3. In a tuning system including a tuning device adapted to be adjusted to a plurality of positions, a dial, an index cooperating with said dial and adapted to be adjusted correspondingly with said tuning device, a pulley connected to said tuning device, a reciprocating carriage, a belt passing over said pulley and connected at its opposite extremities respectively to the corresponding opposite extremities of said carriage, means to mount said index on said carriage, a screw, a screw threaded member on said screw connected with said carriage, a motor to drive said screw thereby to drive said tuning device and said index, means operatively associated with said tuning device to deenergize said motor when said index and tuning device arrive at certain of said predetermined positions, and manual means to rotate said screw thereby to adjust said index and said tuning device to others of said predetermined positions.

4. In a receiver adapted to be tuned through a range of frequencies, a shaft, a tuning device having a rotor mounted on said shaft and adapted to be adjusted to a plurality of predetermined positions each corresponding to a respective frequency to which said receiver is tunable, a plurality of control keys corresponding respectively to certain of said positions, a screw, a rider cooperating therewith, means comprising a motor to rotate said screw alternately in opposite directions thereby to reciprocate said rider, means to connect said rider to said rotor of said tuning device to adjust said tuning device in accordance with the movement of said rider, said last-named means comprising a pulley mounted on said shaft and a cable passing over said pulley and connected at its opposite extremities respectively to the corresponding opposite extremities of said rider, means responsive to operation of any of said keys to stop said tuning device in that one of said certain positions corresponding to the key operated, means to deenergized said motor, and manual means to rotate said screw thereby to adjust said tuning device to others of said predetermined positions.

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