

1

2,834,216

TUNER DRIVE MECHANISM

Reynald E. Thompson, Mount Prospect, Ill., assignor to Motorola, Inc., Chicago, Ill., a corporation of Illinois

Application April 26, 1955, Serial No. 504,053

6 Claims. (Cl. 74—10.85)

This invention relates generally to tuner drive mechanisms for radio receivers, and more particularly to such mechanisms for providing longitudinal movement of tuning elements operable either by rotary manual tuning means or by motor driven tuning means.

There are many applications in which it is desirable to use motor driven tuning mechanisms for adjusting the frequency of radio receivers or the like. For example, motor driven tuners which stop the receiver when a carrier wave is received are now being used in automobile radios. It is desirable that such tuners can also be manually controlled. Further, in many receivers the tuning elements are movable longitudinally to change the tuning, but the manual control and the motor drive are both rotary. Although gear arrangements have been provided to accomplish the combined motor and manual tuning, these have been relatively complicated and have had the disadvantage that the motor drive results in turning of the manual knob, and/or manual tuning causes back driving of the motor mechanism.

It is, therefore, an object of the present invention to provide a simple and improved mechanism for combining a relatively slow rotary manual drive and a relatively fast rotary motor drive.

A further object of the invention is to provide a simple and compact structure for converting rotary motion from a first relatively fast source and a second relatively slow source, to longitudinal motion.

A still further object of the invention is to provide a tuning drive for manual and motor driven operation in which the operation of either the manual or motor drive does not cause operation of the other.

A feature of the invention is the provision of a tuner drive including a pinion and a threaded gear mounted on a threaded shaft with teeth engaging the pinion, whereby slow movement of the threaded shaft causes the gear to move therealong, and rotation of the pinion rotates the gear to move the same at a reduced rate along the threaded shaft.

Another feature of the invention is the provision of a drive for an automobile radio receiver including longitudinally movable tuning elements, which drive includes a carriage coupled to a gear mounted on a threaded shaft connected to a tuning knob, and a pinion connected to a motor drive engaging the gear and preventing rotation of the gear as the threaded shaft is turned so that the gear moves along the shaft, and with rotation of the pinion causing rotation of the gear to move the same along the shaft while the shaft remains in a fixed position. Accordingly, operation of the motor does not cause rotation of the manual knob and rotation of the manual knob does not cause back driving of the motor. The motor drive may be provided by a signal seeking tuner which includes a mechanism for stopping the driving motion when a signal is received.

Further objects, features and the attending advantages of the invention will be apparent from a consideration

2

of the following description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 illustrates the tuner drive mechanism in accordance with the invention;

Fig. 2 is a cross-sectional view along the lines 2—2 of Fig. 1; and

Fig. 3 is a detail view of the latching apparatus of the drive mechanism.

In practicing the invention there is provided a tuner drive mechanism including a frame on which is rotatably mounted a manual tuning shaft having a threaded periphery. Mounted on the shaft is a gear having a threaded opening for receiving the shaft so that the gear may be moved along the shaft. The gear has peripheral teeth which engage the teeth of an elongated pinion which is substantially coextensive with the threaded portion of the manual tuning shaft. A motor driving mechanism is connected to the pinion for rotating the same. Connected to the gear is a carriage structure to which are coupled longitudinal driving elements such as cores operating in coils to change the inductance of the coils. The motor driving mechanism may include a disengageable portion for breaking the driving connection as may be used in a signal seeking tuner to stop tuning operation when a signal is received. In the operation of the driving mechanism, rotation of the threaded shaft by the manual control knob causes the gear to move along the shaft. This is because the teeth of the gear are meshed with the pinion and so that the gear cannot turn and move along the thread as the shaft is rotated. When the motor driving mechanism rotates the pinion, the gear rotates and as the manual shaft will be stationary, rotation of the gear will cause the same to move along the threads to again drive the carriage and the tuning elements. It will, therefore, be obvious that movement of either driving mechanism will not cause back driving of the other and proper movement of the carriage will take place in response to the relatively slow turning of the manual knob and also the relatively fast rotation of the pinion by the motor driving mechanism.

Referring now to the drawings, in Fig. 1 there is illustrated one embodiment of the tuner drive mechanism in accordance with the invention. The frame 10 includes parallel portions 11 and 12 between which a threaded shaft 13 is pivotally mounted. The shaft 13 includes threads 14 upon the periphery thereof, and may have a portion extending through the frame member 11 having a manual tuning knob 15 connected thereto for manual operation of the tuner. A gear member 16 is provided on the shaft 13, having an opening therein with threads which cooperate with the threads 14 on the shaft 13. The gear member 16 has a tooth peripheral portion 17 which cooperates with the pinion 18 which is likewise pivotally mounted between the frame portions 11 and 12. A carriage 20 is connected to the gear member 16, the gear member being rotatable within an opening in the carriage. A plurality of cores 21 are connected to the carriage 20 and are movable within coils 22 to vary the inductance thereof. These coils may be connected in the tuning circuits of a radio receiver for changing the frequency which is selected by the receiver. The operation of such coils and cores is well known in the art.

A motor driven mechanism is provided for driving the pinion 18. This may include an electric motor 25 and disengageable coupling means for connecting the same to pinion 18 as may be desired for signal seeking tuning operation. As shown in Fig. 1, the motor 25 has a drive shaft 26 to which a pinion 27 is secured. The pinion is in engagement with a planet gear 28 pivotally mounted on a rotating member 29 which is coaxial with the motor shaft 26. Connected to the planet gear 28 is a pinion gear 30 which meshes with gear 31 connected to the long

3

pinion 18. This gear arrangement is generally termed a planetary gear structure with the planet gear 28 moving around the pinion 27 and the pinion 30 moving around the gear 31 as the motor is driven, in the event that the rotating member 29 is free to rotate about its axis. However, when the rotating member 29 is held against rotation, the pinion 27 connected to the motor shaft will drive the planet gear 28 which in turn will drive the pinion 30 which drives the gear 31 connected to the long pinion 18. In order to hold the rotary member against rotation, the member 29 may have external teeth, and a latching member 32 may be pulled down against the teeth to hold the same in fixed position. This is shown in Fig. 3. The latching member 32 may be operated by an electro-mechanical structure 33, which may be a relay or any other suitable means. This structure is disclosed and claimed in my copending application Serial No. 487,989 filed February 14, 1955.

Considering now the operation of the tuner in accordance with the invention, it will be apparent that when the manual knob 15 is turned, rotating the shaft 13, the gear 16 which is held against rotation because of engagement with a pinion 18 will move longitudinally along the shaft 13. This will cause the carriage 16 to move longitudinally to move the tuning elements. Friction members 35 may be coupled to the pinion 18 to prevent rotation of the pinion in response to rotation of the manual control knob 15. The rate of movement of the carriage and cores will, of course, depend upon the pitch of the threads of member 13. This can be adjusted to provide the full tuning range by 6 revolutions of the tuning shaft, for example, as has been found to be desirable in some applications.

In response to motor operation of the tuner, the pinion 18 will cause the gear 16 to rotate and as the manual shaft 13 will remain fixed, the gear will move along the shaft to move the carriage longitudinally. In order to assure that the manual shaft is held against rotation during motor driving operation, friction means 36 may be provided to resist rotation of the shaft 13. As will be apparent, a plurality of revolutions of pinion 18 will be required to cause one revolution of the gear 16, so that the relatively high speed rotation of the motor will, in effect, be slowed down to provide the desired tuning speed. Although the planetary gear structure will also reduce the speed of the motor drive, since the tuner drive mechanism itself reduces the speed it is unnecessary to provide such a great reduction in the planetary gear structure to thereby simplify this structure.

It will be apparent from the above that tuner drive mechanism disclosed provides both low speed manual and high speed motor driving of a longitudinally movable tuning element in a relatively simple over-all mechanism. The structure has the advantage that the manual drive does not back drive the motor, and the motor drive does not cause the manual knob to turn. The system is particularly adaptable for use in signal seeking tuners and for use in automobile radio receivers wherein a compact and rugged structure is required.

I claim:

1. A tuner drive mechanism for controlling the position of longitudinally movable tuning elements by operation of a first relatively low speed manual rotary control and of a second relatively high speed motor driven rotary control, said mechanism including in combination, a first elongated member adapted to be actuated by the manual control and mounted for rotation about its longitudinal axis, said first member having a threaded periphery, a gear member having peripheral teeth and further having a threaded center opening for receiving said first member, a second elongated member formed of pinion stock adapted to be actuated by the motor driven control, said second member being mounted for rotation about its longitudinal axis and being at least partially coextensive longitudinally with said first member, said second member hav-

4

ing teeth intermeshed with said teeth of said gear member, and means rotatably coupled to said gear member for moving the tuning elements, whereby rotation of said first member causes said gear member to move without rotation along said threaded first member, and rotation of said second member causes rotation of said gear member so that it moves along said first member which remains at rest.

2. A tuner drive mechanism for controlling the position of longitudinally movable tuning elements by operation of a first relatively low speed manual rotary control and of a second relatively high speed motor driven rotary control, said mechanism including in combination, a frame structure, a shaft mounted for rotation on said frame structure and adapted to be connected to the manual control, said shaft having a threaded periphery, a gear member having peripheral teeth and a threaded center opening for receiving said shaft, an elongated pinion mounted for rotation on said frame structure and adapted to be connected to the motor driven control, said pinion being at least partially coextensive longitudinally with said shaft and having teeth intermeshed with said teeth of said gear member, and carriage means connected to said gear member for moving the tuning elements, whereby rotation of said shaft causes said gear member to move without rotation along said threaded periphery thereof, and rotation of said pinion causes rotation of said gear member and movement thereof along said threaded periphery of said shaft.

3. A tuner drive mechanism for controlling the position of longitudinally movable tuning elements by operation of a first relatively low speed manual rotary control and of a second relatively high speed motor driven rotary control, said mechanism including in combination, a frame structure, a shaft mounted for rotation on said frame structure and adapted to be connected to the manual control, said shaft having a threaded periphery, an elongated pinion mounted for rotation on said frame structure substantially parallel to said shaft and adapted to be connected to the motor driven control, a gear member having a threaded center opening about said shaft and having peripheral teeth intermeshed with the teeth of said pinion, and carriage means for moving the tuning elements, said gear member having a portion rotatably connected to said carriage means whereby rotation of said shaft causes said gear member to move without rotation along said threaded periphery thereof, and rotation of said pinion causes rotation of said gear member and movement thereof along said threaded periphery of said shaft.

4. A tuner drive mechanism for controlling the position of longitudinally movable tuning elements including in combination, a first elongated shaft member mounted for rotation about its axis and having a threaded periphery, manual control means connected to said shaft member, a gear member having a threaded center opening for receiving said shaft member, an elongated pinion member mounted for rotation about its axis and being substantially parallel to said shaft member, said gear member having teeth intermeshed with teeth of said pinion member, motor driving means connected to said pinion member, and means connected to said gear member for moving the tuning elements, whereby rotation of said shaft member by the manual control causes said gear member to move without rotation along said threaded shaft member, and rotation of said pinion member causes rotation of said gear member to cause movement thereof along said shaft member which remains at rest.

5. A tuner drive mechanism for controlling the position of longitudinally movable tuning elements of a radio receiver including in combination, a first elongated shaft member mounted for rotation about its axis and having a threaded periphery, manual control means connected to said shaft member, a gear member having a threaded center opening for receiving said shaft member, an elon-

5

gated pinion member mounted for rotation about its axis and being substantially parallel to said shaft member, said gear member having teeth intermeshed with teeth of said pinion member, motor driving means including a portion connected to said pinion member and a disengageable portion, means coupled to said disengageable portion for disengaging the same in response to the reception of a carrier wave by the radio receiver, and means connected to said gear member for moving the tuning elements, whereby rotation of said shaft member by the manual control causes said gear member to move without rotation along said threaded shaft member, and rotation of said pinion member causes rotation of said gear member so that it moves along the shaft member which remains at rest.

6. A tuner drive mechanism for controlling the position of longitudinally movable tuning elements of a radio receiver including in combination, a first elongated shaft member mounted for rotation about its axis and having a threaded periphery, manual control means connected to said shaft member, a gear member having a threaded center opening for receiving said shaft member, an elongated pinion member mounted for rotation about its axis and being substantially parallel to said shaft member,

6

said gear member having teeth intermeshed with teeth of said pinion member, motor driving means including a first portion connected to said pinion member and a planetary gear portion including a rotary member which when held stationary provides a driving connection to said first portion and which when allowed to rotate disengages the driving connection, and control means responsive to the reception of a carrier wave by the radio receiver for holding said rotary member during tuning operation and for releasing the same when a carrier wave is received, and means connected to said gear member for moving the tuning elements, whereby rotation of said shaft member by the manual control causes said gear member to move without rotation along said threaded shaft member, and rotation of said pinion member causes rotation of said gear member so that it moves along the shaft member which remains at rest.

References Cited in the file of this patent

UNITED STATES PATENTS

2,529,660	Meyers et al. -----	Nov. 14, 1950
2,544,918	Demulenaere et al. -----	Mar. 13, 1951