June 30, 1942. B. O. BROWNE 2,288,435

REMOTE CONTROL APPARATUS

Filed Sept. 24, 1940

FIG. 1

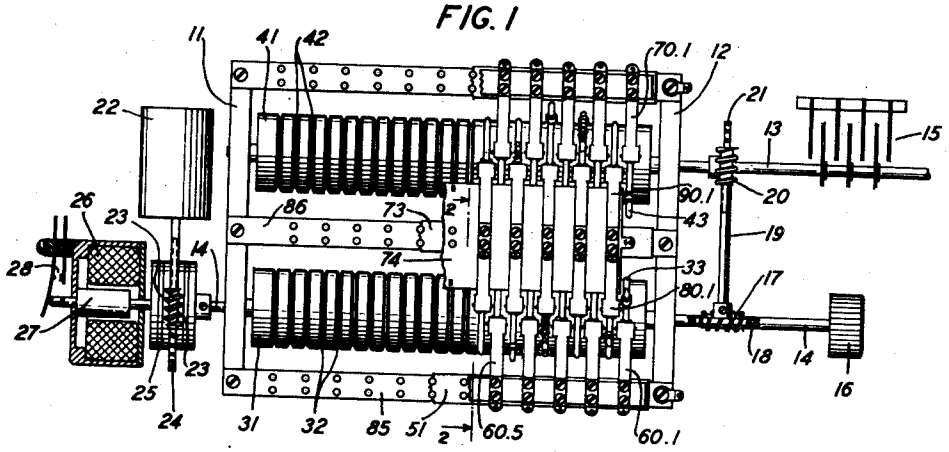

FIG. 2

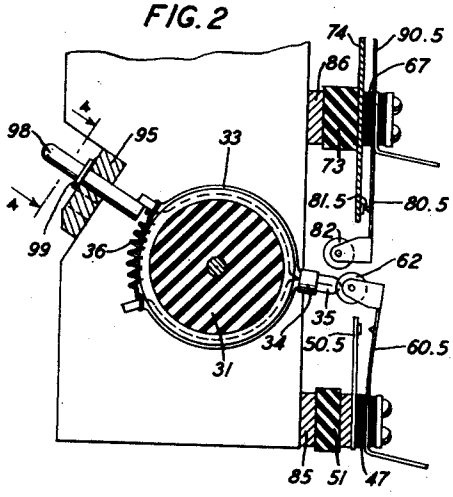

FIG. 3

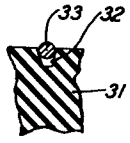

FIG. 4

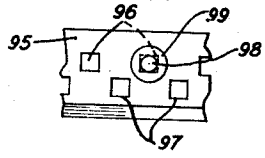

FIG. 5

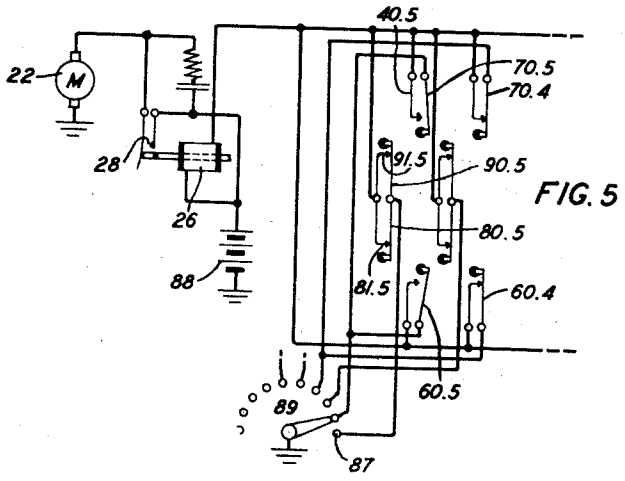

FIG. 6

INVENTOR
B.O. BROWNE
BY
G. H. Stevenson
ATTORNEY

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REMOTE CONTROL APPARATUS

Bennie O. Browne, Maplewood, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application September 24, 1940, Serial No. 358,126

6 Claims. (Cl. 74—568)

This invention relates to remote control mechanism and particularly to tuning mechanism for radio receivers.

An object of this invention is to provide a simple, compact and efficient device for accurately adjusting a tuning shaft of a radio receiver to any of a large number of preselected positions.

Various mechanisms for controlling the tuning position of the condenser or variable inductance elements of radio apparatus are known in the art. One general type of such mechanism is that employing cams for determining the position of the shaft of the tuning element. In such tuners the cams are arranged to operate circuit contacts to interrupt the action of the operating mechanism when the shaft has reached a desired position. Such cams must be readily adjustable so that the position at which the tuner is set to stop can be accurately and easily set and reset. Also, once the cams are set to the desired position, they must maintain their adjustments throughout a continued use of the mechanism. Further requirements particularly in the case of tuning mechanisms for use with radio sets in airplanes or similar service is that the weight and space requirements of the apparatus be kept at a minimum.

These and other objects are achieved by the control mechanism of the present invention, one embodiment of which is shown in the accompanying drawing in which:

Fig. 1 shows a plan view of the tuning control mechanism;

Fig. 2 is a sectional elevation taken along the line 2—2 of Fig. 1;

Fig. 3 is a sectional view of part of the cam cylinder 31 and one of the cams 33;

Fig. 4 is a partial detail view taken along the lines 4—4 of Fig. 2;

Fig. 5 is a schematic circuit diagram of the operating circuit of the tuner; and

Fig. 6 is a partial detail view of a modification of the structure of one of the cams.

Referring to the drawing, the main apparatus is mounted in a frame comprising the end members 11 and 12 joined together by suitable cross-pieces 85, 86, etc. Journaled in the end members 11 and 12 are two shafts 13 and 14. The shaft 13 carries on its right-hand end the movable plates of a variable air condenser 15 which is controlled by the mechanism. Shaft 14 has on its right-hand end a knob 16 for permitting manual adjustment of tuning condenser 15. Shaft 14 also carries a worm 17 which meshes with a worm gear 18 carried by a counter-shaft 19. On the other end of the counter-shaft 19 is a worm 20 meshing with a worm gear 21 carried by the shaft 13. Through this double worm and gear drive, the motion imparted to the drive shaft 14 is transmitted to the tuning shaft 13 with considerable speed reduction.

For remote control, the drive shaft 14 is driven by a motor 22 carrying on its shaft a worm 23 which meshes with a gear 24 which is coupled to the shaft 14 by a clutch 25 which is operated by the solenoid 26. When the solenoid 26 is de-energized, its armature 27 is in the left-hand position as shown and the clutch 25 is released. When electrical current is applied to the solenoid 26, the armature is moved to the right-hand position causing the clutch 25 to engage the worm gear 24 so that the motor 22 drives the shaft 14. This movement of the armature 27 to the right by the energization of the solenoid 26 also closes the relay contacts 28.

Within the frame the shaft 14 carries a cam cylinder 31 provided with a plurality of tapered circumferential grooves 32 in which are mounted the cams 33. The shaft 13 carries a similar cam cylinder 41 provided with similar grooves 42 for carrying similar cams 43.

Figs. 2 and 3 show in detail the construction of the cams 33 and the method of mounting them on the cylinder 31. The construction of the cams 43 and the method of mounting in the cylinder 41 are identical. The cam 33 is in the form of an open-ended circular loop of resilient wire, such as the spring tempered phosphor-bronze. At a point on the circumference of the loop directly opposite the center of the open portion, the wire is bent into a small tightly closed loop and clamped by a ring 34 to form the camming surface 35. The cams 33 are preferably formed in an open-ended circular loop having a diameter slightly smaller than the outside diameter of the cylinder 31 so that they will be fit tightly into the corresponding groove 32 and be clamped therein by the spring action of the wire. This clamping action is further increased by means of the spiral tension spring 36 which is attached to the two open ends of the loop.

Mounted along the one end of the frame is a metallic bar 45 which is supported by the insulator 51. Spaced along the metallic bar 45 is a series of contact springs 50. (These like the other contact springs and arms of the device are designated by the decimal designations 50.1, 50.2 . . . 50.5, etc., in order to identify the different groups of similar contacts.) Associated

with each contact spring 50 is a contact arm 60 having one end mounted on an insulator 67. The free end carries a roller 62 which is operated by the cam surface 35 of the corresponding cam 33.

Similar arms 70 and associated contact springs 40 are carried along the other edge of the frame and associated with the cams 43.

Along the center of the frame and insulated therefrom by the insulator 73 is a conductor plate 74 carrying on each end a series of spaced contact points 81 and 91. (The contact points 91 are not shown in the mechanical assembly, being under the corresponding contact arms 90.) Associated with each of the contacts 81 is a contact arm 80 carrying on its free ends a roller 82. Similar contact arms 90 are associated with each of the contacts 91. Each of the corresponding arms 80.1 and 90.1 . . . 80.5 and 90.5, etc., are formed of a single strip mounted on an insulator 67.

In order to permit adjustment of the positions of the cams 33 on the cylinder 31, there is provided a longitudinal bar 95 mounted on the back of the frame. This bar is provided with two rows of holes 96 and 97 shown in Fig. 4. The row 96 is arranged for proper adjusting of those cams associated with the contact arms 60 and the row 97 is arranged for those cams associated with the contact arms 80. A tool 98 having a square shank for fitting into the holes 96 or 97 and a shoulder member 99 is provided for making the adjustment.

When the tool 98 is inserted in one of the holes 96 as shown in the drawing, its inner end will engage one of the ends of the cams 33 and will hold the cams against movement as the cylinder 31 is rotated by means of the knob 60. The position of the bar 95 and the row of holes varying is so adjusted that the tool 98 holds the cam 33 in such a position that the cam surface 35 is in contact with the roller 62 to break the contact between the arm 60 and the contact springs 50.

A similar bar (not shown) with similar rows of holes is provided for the cam members 43.

The resilient action of the wire forming the cam 33 together with the tension of the spring 36 tends to force the cam into the tapered groove 32 thus maintaining it very rigid against rotation by pressure applied to the cam surface 35. On the other hand, pressure applied to one end of the loop by the tool 98 tends to lift the cam out of the groove 32 so that it may be readily rotated to adjust its angular position.

The use of the two sets of cams 33 and 43 provides what may be termed a micrometer control of the angular position of the shaft 13 and the movable plates of condenser 15 carried thereby. The cams 43 give an approximate adjustment of the position. This is only approximate because each of the cams 43 will operate its associated arm 80 to hold the contacts open through a finite angle of movement of the shaft 13. However, the shaft 14 is driven at a higher speed than the shaft 13. As a result the angle of movement of the shaft 14 in which any one of the cams 33 will operate its arm 60 will correspond to a very small angle of movement of the shaft 13. By connecting one of the sets of contacts operated by a cam 33 in parallel with one of the sets of contacts operated by a cam 43 the motor 22 can be caused to stop only when the two cams are in position to open their corresponding contacts. This will provide a very accurate adjustment of the angular position as will be more clear from the following description of the operating circuit as shown in Fig. 5.

The complete circuit includes, in addition to the schematic showing of the apparatus already described, a battery 83 which supplies the energy for the operation of the device and a control switch 89. In the position in which the switch 89 is shown, the device will just have been operated to bring it to the position shown in all of the figures of the drawing in which the respective one of the cams 33 and 43 will be in the position to operate the arms 60.5 and 70.5 to open the corresponding contacts. With both of these contacts opened, the circuit from the battery 83 through the solenoid 26 is opened thus releasing the clutch 25 and opening the contacts 28 through which current is supplied from the battery 83 to motor 22.

Now if the switch 89 is moved to the contact 87, a circuit will be established from ground through switch 89, contact arms 80.5 and 90.5 and their associated contacts 81.5 and 91.5 in parallel, solenoid 26, battery 83 to ground. This will operate the solenoid 26 to engage the clutch 25 and at the same time to close the contacts 28 establishing a circuit for the motor 22 from the battery 83. The shaft 14 will then be driven by the motor 23 at the same time driving the shaft 13 and the associated condenser 15 through the counter-shaft 19. When the shaft 13 has reached the point where the corresponding cam 43 operates the arm 90.5 to open the circuit at contact 91.5, the circuit will still be established through the contact 81.5. The motion of the mechanism will continue until the corresponding cam 33 is in such a position as to operate the arm 80.5 to open the circuit at contact 81.5. This completely breaks the circuit from the grounded end of the battery 83 to the solenoid 26 and releases the clutch 25 at the same time breaking the electrical circuit to the motor 22 at contacts 28. Due to the large reduction gearing between the shafts 14 and 13, the cam surface 45 of the cam 43 will maintain the arm 90.5 in the operated position until the cam 33 has reached such a position as to operate the arm 80.5 to open the parallel circuit.

In setting the tuner for any particular position, for example, that determined by the contact arms 60.5 and 70.5, the tool 98 is inserted in that one of the holes 96 corresponding to the cam 33 which operates the contact arm 60.5, as shown in Fig. 2. At the same time the other tool is inserted in the hole of the other bar (not shown) corresponding to the cam 43 which operates the contact arm 70.5. Then as the knob 16 is turned to adjust the condenser 15 to the desired position both of the particular cams 33 and 43 will be held by the corresponding tools in such positions as to maintain the contact arms 60.5 and 70.5 operated to open their contacts. When the knob 16 has been adjusted so that the condenser 15 is in the desired position the tools are removed. The cams then will be adjusted to the proper angular positions on the respective cylinders 31 and 41 to cause the mechanism to return to the same position when the proper contact of switch 89 is closed.

What is claimed is:

1. In a device of the character described, a cylindrical member having a tapered wall circumferential groove and a cam member adapted to be adjustably mounted in said groove, said

cam member comprising a split ring of resilient material.

2. In a device of the character described, a cylindrical member having a tapered wall circumferential groove and a cam member adapted to be adjustably mounted therein, said cam member comprising a split ring of resilient material, the diameter of said ring in the unstressed condition of said material being smaller than the diameter of said cylinder.

3. In a device of the character described, a cylindrical member having a tapered wall circumferential groove and a cam member adapted to be adjustably mounted therein, said cam member comprising a split ring of resilient material, the diameter of said ring being smaller than the diameter of said cylinder when said material is in an unstressed condition, and a tension spring attached to the ends of said split ring.

4. In a device of the character described, a cylindrical member having a tapered wall circumferential groove, and a cam member adapted to be adjustably mounted in said groove, said cam member comprising a split ring of resilient material having a raised portion at one point on the circumference of said ring adapted to operate a contact member.

5. In a device of the character described, a cylindrical member having a tapered wall circumferential groove, and a cam member adapted to be adjustably mounted in said groove, said cam member comprising a split ring of resilient wire, one portion of the circumference of said ring being bent to form a raised cam surface and the diameter of said ring in the unstressed condition of said material being smaller than the diameter of said cylinder.

6. In a device of the character described, a cylindrical member having a tapered wall circumferential groove, a cam member adapted to be adjustably mounted in said groove, said cam member comprising a split ring of resilient wire, said wire being bent at one portion on the circumference of said ring to form a raised cam portion and the diameter of said ring in the unstressed condition of said material being smaller than the diameter of said cylinder, and an adjusting member arranged to engage one end of said split ring when said raised cam portion is in the operating position to permit the adjustment of said cam by the rotation of said cylindrical member.

BENNIE O. BROWNE.