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(54) TURRET TUNER

(71) We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, of Abacus House, 33 Gutter Lane, London, E.C.2., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

The invention relates to a frequency selector for tuning to preselected frequencies, comprising a rotatable turret carrying a plurality of axially adjustable abutment screws which can be brought selectively into an operative position by stepwise rotational movement of the turret, a movable member which is connected with a tuning means of the selector and which cooperates with the abutment screw which is in said operative position so as to be positioned thereby to set the tuning means to a frequency corresponding to that abutment screw, an axially movable first control member, means for converting axial movement of this control member into rotary movement of a Geneva mechanism which is arranged to impart stepwise rotational movement to the turret, a plurality of rotatable toothed adjusting nuts provided one on each of the abutment screws for axial adjustment of these screws, a second control member which comprises a toothed adjusting wheel for cooperation with the toothed adjusting nuts and which is rotatable about an axis parallel to the axis of movement of the first control member and is also axially movable between a first position in which the toothed adjusting wheel meshes with one of the toothed adjusting nuts and a second position in which the adjusting wheel does not mesh with any of the adjusting nuts, and a member which is connected to the first control member for movement therewith and which is operable during actuation of the first control member to move the second control member, if the latter is in said first position, from this position to the second position.

A frequency selector of this construction is

known from British Patent Specification No. 1,306,437. In this known selector the first control member for changing the preselection frequency is coupled to the second control member for fine tuning, so that when the first control member is depressed, the toothed adjusting wheel is disengaged from the relevant toothed adjusting nut. The toothed adjusting wheel, however, always engages one of the adjusting nuts again upon the return of the first control member to the neutral position.

It is a drawback of this known frequency selector that accidental and/or unintended rotation of the second control member in the neutral position of the two control members can cause undesired adjustment of the preselection frequency associated with a given abutment screw. Therefore, for the advantages of the preselection to be utilized, it is necessary in the known selector that the second control member should not be touched except when the preselection frequency is to be changed.

The invention has for its object to provide a frequency selector wherein the risk of unintended changing of the preselection frequency is substantially reduced.

According to the invention there is provided a frequency selector for tuning to preselected frequencies, comprising a rotatable turret carrying a plurality of axially adjustable abutment screws which can be brought selectively into an operative position by stepwise rotational movement of the turret, a movable member which is connected with a tuning means of the selector and which cooperates with the abutment screw which is in said operative position so as to be positioned thereby to set the tuning means to a frequency corresponding to that abutment screw, an axially movable first control member, means for converting axial movement of this control member into rotary movement of a Geneva mechanism which is arranged to impart stepwise rotational movement to the turret, a plurality of rotatable toothed adjusting nuts provided one on each of the abutment screws

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for axial adjustment of these screws, a second control member which comprises a toothed adjusting wheel for cooperation with the toothed adjusting nuts and which is rotatable about an axis parallel to the axis of movement of the first control member and is also axially movable between a first position in which the toothed adjusting wheel meshes with one of the toothed adjusting nuts and a second position in which the adjusting wheel does not mesh with any of the adjusting nuts, a member is connected to the first control member for movement therewith and which is operable during actuation of the first control member to move the second control member, if the latter is in said first position, from this position to the second position, and resilient latching means for retaining the second control member in that one of the first and second positions to which it is moved.

In one embodiment of the invention the second control member comprises a shaft which is provided with a first circumferential groove which corresponds to the first position of the second control member and with a second circumferential groove which corresponds to the second position of the second control member and is spaced axially of the shaft from the first groove, and the latching means comprise a spring wire which is secured to a frame of the selector and which extends substantially in a plane extending transversely of said shaft, the spring wire being arranged to engage in the first circumferential groove in the first position of the shaft and in the second circumferential groove in the second position of the shaft.

A frequency selector according to an embodiment of the invention will be described in detail hereinafter with reference to the accompanying drawings, in which:—

Figure 1 is a sectional plan view of the frequency selector,

Figure 2 is a view drawn to an enlarged scale of a threaded bush included in the selector shown in Figure 1, and

Figure 3 is an end view of the threaded bush shown in Figure 2.

The frequency selector shown in Figure 1 comprises a first control member which comprises a push-button rod 3 which is slidable in a frame 1 and to which a slide 5 is connected. The button rod 3 is provided with a push-button 7. A return spring 9 is arranged between the frame 1 and the control knob 7. The return spring 9 surrounds the button rod 3. A spindle 11 which extends parallel to the button rod 3 is rotatably journaled in the frame 1. The spindle 11 extends through a bore 13 in the slide 5, which can be slid along the spindle by pressing the push-button 7. The slide 5 is provided with a drive pin 15 which projects radially into the bore 13 and engages in an endless groove 17 in the spindle 11. The groove 65 extends helically around the circumference of

the spindle 11 so that when the push-button 7 is depressed and then released, the resulting reciprocatory movement of the button rod 3 is converted into a rotation of the spindle 11 through one complete revolution by the cooperation between the drive pin 15 and the groove 17. On the front end of the spindle 11 there is fixed a disc 19 from which projects a pin 21 which is eccentrically arranged with respect to the spindle axis.

The eccentric pin 21 forms the driving part of a Geneva mechanism of which the driven part is formed on a turret 25 secured on a shaft 29 which is rotatably supported in the frame 1 parallel with the spindle 11. The driven part of the Geneva mechanism comprises six radial grooves 27 formed in the front face of the turret 25. During a part of each revolution of the spindle 11 the driving pin 21 cooperates with one of the radial grooves 27 to turn the turret 25 through a step of one sixth of a revolution. During the remainder of the revolution of the spindle 11 the turret 25 is prevented from rotating by a shoulder 23 on the disc 19, which shoulder is situated diametrically opposite the eccentric pin 21 and, as the pin leaves the relevant radial groove 27, engages in a respective one of six recesses 26 which are formed in the front face of the turret 25, the recesses alternating with the grooves 27. The recesses each have a concave arcuate wall and the shoulder 23 is of convex arcuate form to cooperate in the conventional manner with the arcuate wall of the recess in which the shoulder engages.

A complete rotation of the turret 25 is achieved only after the push-button 7 has been depressed six times.

The turret 25 is provided with six abutment screws which are equipped around the axis of the turret. Only three of the abutment screws, designated 31, 33 and 35, are visible on Figure 1. The abutment screws are provided with a fine screw-thread and are axially adjustable by means of rotatable adjusting nuts, of which three are visible, designated 37, 39 and 41, and which are each provided with external teeth. The adjusting nuts are locked against axial movement and the abutment screws against rotation in the turret 25. The manner in which the adjusting nuts are turned will be described in detail hereinafter. By step-wise rotation of the turret 25, each of the abutment screws can be moved to the operative position occupied by the abutment screw 31 in Figure 1. The free end of the abutment screw (31) which occupies this position co-operates with a feeler rod 43 which is slidable parallel to the turret shaft 29 in a turning slide 47 which is also slidable in a direction parallel to the turret shaft 29. The slide 47 is coupled to a tuning means 49 of the selector, for example, a cone slidable in coil. The feeler rod 43 is provided with a collar 51 which is pressed against the tuning slide 47 by a spring 45. The rod 43 is provided near its end

which abuts the operative abutment screw (31) with a second collar 53 which is engageable by an arm 55 connected to the slides. Each time the push-button 7 is depressed, the feeler rod 43 is displaced axially by the arm 55 out of engagement with the operative abutment screw (31). Through the spring 45 the turning slide 47 is moved with the rod 43 against the force of a spring 57. The spring 45 is stronger than the spring 57, so that when the abutment screw 31 is axially displaced, the rod 43 does not move relative to the turning slide 47. The distance between the free end of each of the abutment screws (31, 33 and 35) and the turret 25 defines a corresponding rest position of the rod 43 and therefore a given position of the movable core of the tuning means 49. Each of the six abutment screws in the turret 25 corresponds to a predetermined position of the movable core and hence to a preselected frequency. Hereinafter it will be described how the preselected frequency, for example, a radio or television frequency, can be adjusted.

A Fine-tuning shaft 59 forming a second control member is rotatably journaled in the frame 1, this shaft also being slidable in a direction parallel to the turret shaft 29. An adjusting gearwheel 61 is arranged on the tuning shaft 59. The gearwheel 61 is locked against rotation with respect to the tuning shaft 59 by means of a locking pin 63 which is fixed in the tuning shaft and which engages slidably in a slot 65 which extends axially in the gearwheel 61. The gearwheel 61 is pressed against a collar 69 on the tuning shaft 59 by a comparatively light compression spring 67. The compression spring 67 is located between the gearwheel 61 and a further collar 71 on the tuning shaft 59. the tuning shaft can be rotated and displaced axially by means of a control knob 73. The abutment screw which is situated in the operative position (the abutment screw 31 in Figure 1) is axially adjusted by rotating the control knob 73. This turns the gearwheel 61, which in the position shown meshes with the adjusting nut (37) on the operative abutment screw (31), and since the adjusting nuts are locked against axial movement in the turret 25, the operative abutment screw (31) is displaced in the axial direction when the nut on this screw rotates. The preselection tuning frequency associated with the operative abutment screw (31) is thus adjusted. Each of the six abutment screws can thus be adjusted its own preselected tuning frequency.

The fine-tuning shaft 59 is formed with two circumferential grooves 75 and 77 which are spaced axially from each other and each of which co-operates in a corresponding axial position for the tuning shaft with a spring wire 79 which is secured near its ends to the frame 1 and which forms a resilient latching means for retaining the tuning shaft in either of the two axial positions thereof. An externally screw-threaded bush 81 is secured in an opening in

the frame 1 by means of a nut 80, the tuning shaft 59 being inserted through the bush. The bush 81 is provided internally of the frame 1 with a transverse slot 83 which extends through the cylindrical wall of the bush in a plane extending transversely of the axis of the bush, and in which the central portion of the spring wire 79 is situated (see also Figures 2 and 3) so as to be held by the walls of the slot in a plane extending transversely of the shaft 59. On the inner side of the frame 1 are two bent-over lugs 85 and 87 which are situated one on each side of the bush 81 and behind which the ends of the spring wire 79 are hooked. The positions of the lugs 85 and 87 are the transverse slot 83 with respect to each other in the plane containing the spring wire 79, and the depth of the transverse slot 83 (see Figure 2), are such that, when one of the circumferential grooves 75 or 77 in the shaft 59 is in engagement with the spring wire 79, this wire is lightly biased against the bottom of the relevant circumferential groove. The manner in which the tuning shaft 59 is axially displaced when the frequency selector is in operation will be described in detail hereinafter.

The slide 5 which is connected to the push-button rod 3 is provided with a catch 89 which engages behind the tuning gearwheel 61 in the position shown. In the operating position shown in Figure 1, the preselection of the selector is adjusted to the tuning frequency corresponding to the abutment screw 31 when the user wishes to change the preselection to another frequency (abutment screw), the push-button 7 is depressed against the force of the spring 9 and is released again. Through the Geneva mechanism the turret 25 is thereby rotated through one step in the described manner to bring the next abutment screw 33 into the operative position for cooperation with the feeler rod 43. During the depression of the push-button 7, the catch 89 disengages the adjusting gearwheel 61 from the adjusting nut 37 and also, through the gearwheel 61 and the spring 67, displaces the entire tuning shaft 59 over a distance equal to the centre-to-centre distance between the circumferential grooves 75 and 77 in the tuning shaft 59. The spring wire 79, which initially engaged the circumferential groove 75 to hold the shaft 59 in a first position (the position shown in Figure 1), consequently now engages the circumferential groove 77 and retains the tuning shaft 59 in a second position corresponding to the latter groove, whilst the push-button rod 3 returns to its neutral position. During each subsequent change from one preselection frequency (abutment screw) to another, the tuning shaft 59 remains in the second position. Accidental and/or unintended touching of the control knob 73 is thus prevented from adjusting the preselection frequency associated with the abutment screw which is in the operative position. If the preselection frequency

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corresponding to this abutment screw is to be adjusted, the procedure is as follows, assuming that the abutment screw 33 is in the operative position. When the control knob 73 is pulled, the tuning shaft 59 is returned to the first position wherein the spring wire 79 engages the circumferential groove 75. The tuning gear-wheel 61 is thereby brought into meshing engagement with the adjusting nut 39 of the abutment screw 33. The preselection frequency corresponding to the abutment screw 33 can then be adjusted by rotating the control knob 73. If the teeth of the gearwheel 61 do not engage the teeth of the adjusting nut 39 when the tuning shaft 59 returns to the first position, the spring 67 is slightly compressed. A slight rotation of the control knob 73 then causes the adjusting gearwheel 61 to mesh with the adjusting nut 39.

The threaded bush 81 is preferably constructed as shown in Figures 2 and 3. Near its end which is situated inside the frame 1 (see also Figure 1), the bush 81 is provided with a hexagonal collar 90 which also forms a shoulder which abuts against the frame 1. The threaded bush is locked against rotation by means of two projections 91 and 93 which are formed on the frame 1 at locations such that they will be in contact, or practically in contact, with two opposite flats of the hexagonal collar 90 when the bush is fitted in the frame 1. The hexagonal collar 90 is provided with a circular groove 95 which ensures that the collar seats firmly on the frame. In the interests of accurate centering, a portion 97 of the bush which adjoins the collar 80 is left unthreaded. The bush is provided with a screw-thread 90 which is separated from the unthreaded portion 97 by a reduced portion 101. The bush is provided with three coaxial cylindrical bore 103, 105 and 107 of different diameters. The bore 105 has a diameter which substantially equals the diameter of the tuning shaft 59. The bore 103 and 107 have larger diameters which leave clearances around the tuning shaft 59 so as to reduce the risk of jamming during the axial and rotational movements of the shaft 59. The bore 107 has a diameter and length such that a control knob 73 having a hollow stem can be (fitted on the shaft 59 and) the stem can slide freely in the bore 107 when the tuning shaft 59 is axially displaced.

The frequency selector (Figure 1) is provided with coarse-tuning means which are operated by the push-button rod 3 and which is partly shown in diagrammatic form. The coarse-tuning means comprise a wave-length switch 109 of a commonly used type which is operated by means of a switching rod 111. The switching rod 111 is connected to a slide 113 which is provided with a first projection 115 which co-operates with a profiled disc 117 fixed on the turret shaft 29. A tension spring 119 is connected to the slide 113. The slide 113, which may be made of synthetic material, is

provided with a second projection 121 having a bevelled face 123. The bevelled face 123 co-operates with a bevelled face 125 formed on the push-button rod 3. The profiled disc 117 has a number of peripheral sections which correspond to the frequency ranges associated with given preselection frequencies which can be accurately adjusted in the tuning member 49 by means of the abutment screws on the turret 25. When the button rod 3 is displaced by means of the push-button 7 to change the preselection frequency, the bevelled faces 123 and 125 cooperate to displace the slide 113 to the right against the force of the tension spring 119. As soon as the projection 115 is out of the reach of the profiled disc 117, the Geneva mechanism 21, 23, 27 rotates the turret 25, and with it the disc 117, through one step. When the button rod 3 returns to its neutral position, the slide 113 is displaced to the left by the spring 119 and the projection 115 occupies a position which is determined by that section of the periphery of the profiled disc 117 which is engaged by the projection 115. The profiled disc 117 is provided with separate peripheral sections. However, it is alternatively possible to use a profiled disc having peripheral sections which run smoothly one into the other, and to have this disc continuously contacted by the projection 115. The second projection 121 can then be dispensed with. A greater force will be required for operating the knob 7, however, because the rotation of the turret 25 takes place at the same instant as the displacement of the slide 113. In order to avoid an unacceptably high push-button pressure, a profiled disc can be used which is arranged on its own shaft and which is driven by the spindle 11. The profile of the disc can be so designed that the rotation of the turret 25 does not coincide with the displacement of the slide 113.

It can be seen that in the above frequency selector, which is very suitable for use as a station selector in a car radio, the risk of unintended adjustment of any of the preselection frequencies is substantially reduced, in that any change from one preselection frequency to another automatically uncouples the fine-tuning means from the relevant control section.

WHAT WE CLAIM IS:—

1. A frequency selector for tuning to preselected frequencies, comprising a rotatable turret carrying a plurality of axially adjustable abutment screws which can be brought selectively into an operative position by step-wise rotational movement of the turret, a movable member which is connected with a tuning means of the selector and which co-operates with the abutment screw which is in said operative position so as to be positioned thereby to set the tuning means to a frequency corresponding to that abutment screw, an axially movable first control member, means for converting axial movement of this control



corresponding to this abutment screw is to be adjusted, the procedure is as follows, assuming that the abutment screw 33 is in the operative position. When the control knob 73 is pulled, the tuning shaft 59 is returned to the first position wherein the spring wire 79 engages the circumferential groove 75. The tuning gear-wheel 61 is thereby brought into meshing engagement with the adjusting nut 39 of the abutment screw 33. The preselection frequency corresponding to the abutment screw 33 can then be adjusted by rotating the control knob 73. If the teeth of the gearwheel 61 do not engage the teeth of the adjusting nut 39 when the tuning shaft 59 returns to the first position, the spring 67 is slightly compressed. A slight rotation of the control knob 73 then causes the adjusting gearwheel 61 to mesh with the adjusting nut 39.

The threaded bush 81 is preferably constructed as shown in Figures 2 and 3. Near its end which is situated inside the frame 1 (see also Figure 1), the bush 81 is provided with a hexagonal collar 90 which also forms a shoulder which abuts against the frame 1. The threaded bush is locked against rotation by means of two projections 91 and 93 which are formed on the frame 1 at locations such that they will be in contact, or practically in contact, with two opposite flats of the hexagonal collar 90 when the bush is fitted in the frame 1. The hexagonal collar 90 is provided with a circular groove 95 which ensures that the collar seats firmly on the frame. In the interests of accurate centering, a portion 97 of the bush which adjoins the collar 80 is left unthreaded. The bush is provided with a screw-thread 90 which is separated from the unthreaded portion 97 by a reduced portion 101. The bush is provided with three coaxial cylindrical bore 103, 105 and 107 of different diameters. The bore 105 has a diameter which substantially equals the diameter of the tuning shaft 59. The bore 103 and 107 have larger diameters which leave clearances around the tuning shaft 59 so as to reduce the risk of jamming during the axial and rotational movements of the shaft 59. The bore 107 has a diameter and length such that a control knob 73 having a hollow stem can be (fitted on the shaft 59 and) the stem can slide freely in the bore 107 when the tuning shaft 59 is axially displaced.

The frequency selector (Figure 1) is provided with coarse-tuning means which are operated by the push-button rod 3 and which is partly shown in diagrammatic form. The coarse-tuning means comprise a wave-length switch 109 of a commonly used type which is operated by means of a switching rod 111. The switching rod 111 is connected to a slide 113 which is provided with a first projection 115 which co-operates with a profiled disc 117 fixed on the turret shaft 29. A tension spring 119 is connected to the slide 113. The slide 113, which may be made of synthetic material, is

provided with a second projection 121 having a bevelled face 123. The bevelled face 123 co-operates with a bevelled face 125 formed on the push-button rod 3. The profiled disc 117 has a number of peripheral sections which correspond to the frequency ranges associated with given preselection frequencies which can be accurately adjusted in the tuning member 49 by means of the abutment screws on the turret 25. When the button rod 3 is displaced by means of the push-button 7 to change the preselection frequency, the bevelled faces 123 and 125 cooperate to displace the slide 113 to the right against the force of the tension spring 119. As soon as the projection 115 is out of the reach of the profiled disc 117, the Geneva mechanism 21, 23, 27 rotates the turret 25, and with it the disc 117, through one step. When the button rod 3 returns to its neutral position, the slide 113 is displaced to the left by the spring 119 and the projection 115 occupies a position which is determined by that section of the periphery of the profiled disc 117 which is engaged by the projection 115. The profiled disc 117 is provided with separate peripheral sections. However, it is alternatively possible to use a profiled disc having peripheral sections which run smoothly one into the other, and to have this disc continuously contacted by the projection 115. The second projection 121 can then be dispensed with. A greater force will be required for operating the knob 7, however, because the rotation of the turret 25 takes place at the same instant as the displacement of the slide 113. In order to avoid an unacceptably high push-button pressure, a profiled disc can be used which is arranged on its own shaft and which is driven by the spindle 11. The profile of the disc can be so designed that the rotation of the turret 25 does not coincide with the displacement of the slide 113.

It can be seen that in the above frequency selector, which is very suitable for use as a station selector in a car radio, the risk of unintended adjustment of any of the preselection frequencies is substantially reduced, in that any change from one preselection frequency to another automatically uncouples the fine-tuning means from the relevant control section.

WHAT WE CLAIM IS:-

1. A frequency selector for tuning to pre-selected frequencies, comprising a rotatable turret carrying a plurality of axially adjustable abutment screws which can be brought selectively into an operative position by step-wise rotational movement of the turret, a movable member which is connected with a tuning means of the selector and which co-operates with the abutment screw which is in said operative position so as to be positioned thereby to set the tuning means to a frequency corresponding to that abutment screw, an axially movable first control member, means for converting axial movement of this control



member into rotary movement of a Geneva mechanism which is arranged to impart stepwise rotational movement to the turret, a plurality of rotatable toothed adjusting nuts provided on each of the abutment screws for axial adjustment of these screws, a second control member which comprises a toothed adjusting wheel for cooperation with the toothed adjusting nuts and which is rotatable about an axis parallel to the axis of movement of the first control member and is also movable axially between a first position in which the toothed adjusting wheel meshes with one of the toothed adjusting nuts and a second position in which the adjusting wheel does not mesh with any of the adjusting nuts, a member which is connected to the first control member for movement therewith and which is operable during actuation of the first control member to move the second control member, if the latter is in said first position, from this position to the second position, and resilient latching means for retaining the second control member in that one of the first and second positions to which it is moved.

2. A frequency selector as claimed in Claim 1, wherein the second control member comprises a shaft which is provided with a first circumferential groove which corresponds to the first position of the second control member and with a second circumferential groove which corresponds to the second position of the second control member and is spaced axially of the shaft from the first groove, and wherein the latching means comprise a spring wire which is secured to a frame of the selector and which extends substantially in a plane extending transversely of said shaft, the said spring wire being arranged to engage in the first circumferential groove in the first position of the shaft and in the second circumferential groove in the second position of the shaft.

3. A frequency selector as claimed in Claim 2, wherein the shaft is slidable in a bore in a rigidly mounted bush in which is formed a slot which extends in a plane extending transversely of the shaft and through which slot said spring wire passes so as to be held in said plane by the walls of the slot.

4. A frequency selector as claimed in Claim 3, wherein near its ends the spring wire engages behind two projections formed on the frame of the selector on opposite sides of said bush.

5. A frequency selector as claimed in Claim 1, 2, 3 or 4, wherein the member which is connected to the first control member constitutes an extension of a slide connected to the first control member.

6. A frequency selector as claimed in Claim 5, wherein the means for converting axial movement of the first control member into rotary movement of the Geneva mechanism comprise a pin secured to said slide and engaging in an endless groove in a rotatable spindle on which the slide is axially slidable and to which is connected a driving part of the Geneva mechanism, the groove extending helically around the circumference of the spindle.

7. A frequency selector substantially as herein described with reference to the accompanying drawings.

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