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PUSH-BUTTON CONTROL

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16 Claims. (Cl. 74—10.39)

1

This invention relates to improvements in push button control devices of the type employed for automatically tuning radio receiving sets, and has for its object not only to enable swift and convenient adjustment such as required in changing the selection of broadcast stations but also to afford accuracy of adjustment within such narrow limits as to assure the setting of the tuning device at each operation of the push buttons with a high degree of precision.

A further object is to simplify the structure and organization of the parts whereby the cost of production of push button control mechanisms is reduced and the dimensions thereof reduced sufficiently to permit compact accommodation in spaces of small size.

In the accompanying drawings wherein an approved employment of the invention is illustrated:

Figure 1 is a transverse sectional view through the push button control device.

Figure 2 is a longitudinal sectional view there-through.

Figure 3 is a fragmentary and rear elevation of the device.

Figure 4 is a detail section on the line 4—4 of Figure 3.

Figure 5 is an enlarged detail view illustrating the cooperation between the teeth of the drive gear and the thread of the actuating shaft.

Figure 6 is a sectional view on the line 6—6 of Figure 5.

Figure 7 is a sectional view on the line 7—7 of Figure 2.

Referring to the drawing in detail, the numeral 10 indicates a hollow casing the front wall of which slidably supports a plurality of actuating shafts 11 formed at the exposed end thereof to constitute push buttons conveniently operable for changing from station to station to selectively tune the radio which the invention is applied. The rear extremity of each shaft is slidable in a slot 12 formed in the rear wall of the casing and the shafts are normally pressed downwardly at the rear ends by bearing member 13 engaged over the shafts and subjected to the tension of springs 14. The shafts are normally held in forwardly projected position by springs 15a and the forward movement thereof is limited by a stop flange 11a. A pawl 15 pivotally mounted at 16 is engageable in a detent 17 formed in the shaft 11. The pawl 15 is common to the several shafts 11 and extends transversely of them and is normally retained in operative position by a spring 17a. When one of the shafts is moved rearward-

2

ly into operative position, the pawl 15 is deflected thereby releasing the shaft previously actuated and engaging beyond a second detent 18 formed in close proximity to the forward extremity of the shaft.

The medial portion of each shaft 11 is formed with a screw 19 having a prominent and well-defined thread engaging the teeth of an adjustable drive gear 20 supported on a tuning shaft 21 which latter is rotatably supported in the opposite end wall of the casing 10.

Each adjustable drive gear 20 is accurately retained in predetermined position longitudinally of the shaft 21 by engagement against an abutment pin 22, such engagement being maintained by springs 23 confined between collars 24 on the shaft 21 and the drive gears 20.

Each drive gear 20 is rotatably mounted on the shaft 21 and is provided with a drive pin 25 engageable with the related abutment pin 22 for imparting rotary movement in one direction to the tuning shaft 21.

The shaft 21 is movable between limiting stops 21a through an angle of 180 degrees and is subjected to the influence of a spring 21b tending to turn the shaft in the direction of the arrow 26 in Figure 1.

A series of adjusting shafts 27 corresponding in number to the actuating shafts 11 are slidably and rotatably mounted in the front and rear walls of the casing 10 and projected a distance forwardly of the latter for convenience in manipulating them. The rear portion of each adjusting shaft is provided with axially elongated teeth 28 meshing with a gear wheel 29 rigidly mounted on the related actuating shaft 11 whereby rotary adjusting movement of the shaft 27 is transmitted to the related shaft 11. The axial extension of the rear teeth 28 permits freedom of axial movement of the actuating shaft 11 throughout its range of longitudinal movement without, however, altering the angular position of the shaft 11. Each adjusting shaft 27 is normally held in forwardly extended position by a spring 30 and the rear extremity thereof is provided with a toothed disk 31, one of the teeth of which is engageable in one of a circular series of recesses 32 formed in the rear wall of the casing 10. In practice it is permissible to provide 17 teeth on each disk 31 and thirty-two recesses 32 for a purpose which hereinafter appear. The disk 31 is normally flat and when the adjusting shaft 27 is moved rearwardly to change the adjustment of the related actuating shaft 11, the tooth of the disk 31 engaged in one of the recesses

32 is disengaged therefrom and the shaft 27 may be freely rotated. When the shaft 27 is released, however, it is pressed forwardly by the spring 30 and the tooth of the disk 31 nearest the adjacent one of the recesses 32 engages therein while the remaining teeth are flexed angularly, as shown in Figure 1. The engagement of one of the teeth of the disk 31 in the recess 32 serves to lock the adjusting shaft 27 in the selected angular position and by engagement of the rear wheel 29 with the teeth 28, the related shaft 11 is also prevented from turning about its axis. It is also desirable that the ratio between the gear wheels 28 and 29 should be 1 to 4 for improving the precision of adjustment of the device as will hereinafter more fully appear.

As stated above, the tuning shaft 21 turns through an angle of 180 degrees throughout the range of tuning adjustment thereof. Assuming that the shaft in the position shown in Figure 1 has been turned in the direction of the arrow 26 into engagement with the stop 21a limiting rotary movement in that direction and that the drive pin 25 is in engagement with the abutment pin 22, when the actuating shaft 11 is pressed rearwardly, the drive gear 20 is turned through a corresponding angle. When the actuating shaft 11 is fully actuated, the pawl 15 enters the detent 18 and locks the shaft in operative position, the gear wheel 29 engaging and sliding along the gear teeth 28 and thereby preventing rotary movement of the actuating shaft. Upon actuation of one of the other actuating shafts to tune the radio for the reception of a different broadcast station, the inclined surface of the newly actuated shaft 11 deflects the pawl 15 thereby releasing the previously operated shaft 11 which is restored to initial position by the spring 15, whereas the shaft 11 last actuated is retained in operative position by engagement of the pawl 15 with the detent 18.

In case it may be desired to adjust the drive gear 20 for setting the tuning shaft 21 in some other position within its range of angular movement for automatically tuning in a different station upon operation of the actuating shaft 11, the adjusting shaft 27 is pressed rearwardly against the tension of the spring 30 thereby disengaging the teeth of the disk 31 from the recess 32 and thereby permitting freedom of rotary movement of the adjusting shaft. The shaft 11 is pressed rearwardly to its operative position in which it is locked by engagement of the pawl 15 with the detent 18. The shaft 27 is then rotated to engage the drive pin 25 with the abutment pin 22 and in this manner the tuning shaft 21 is turned into the angular position most favorable for the best reception of the selected broadcast station. This adjustment of the drive gear angularly with respect to the tuning shaft is effected by the camming action of the screw thread 19 upon the teeth of the drive gear 20. After the desired adjustment has been effected, the shaft 27 is released and moved forwardly by the spring 30. Thus one of the teeth of the disk 31 is engaged in one of the recesses 32 and the shaft 27 locked in the selected angular position. Simultaneously the actuating shaft 11 and related parts are also locked and the adjustment thus maintained so that at each actuation of the shaft 11 the tuning shaft 21 is turned to the same angular position.

Such lost movement between the parts as might impair the accuracy of adjustment is compensated by the spring normally tending to turn the

shaft 21 and maintaining a point of contact between the teeth of the drive gear 20 and the screw thread 19 as shown in detail in Figures 5 and 6. A close fit of the teeth of the gear 29 with the teeth 28 obviating lost motion between these parts is maintained by the spring 14 coacting with each actuating shaft 11, the tension of the spring tending to press the gear 29 into the teeth 28.

It is of the utmost importance for the extreme accuracy of adjustment in tuning the radio receiving set to lock each actuating shaft 11 and the related drive gear 20 in position within the limitations of the smallest practical angle. This is accomplished, first, by the 1 to 4 ratio between the gears 28 and 29, and, second, by the provision of 17 teeth on the disk 31 and thirty-two recesses 32 in the casing 10. Thus the greatest angular difference between the teeth 31 and a recess 32 is

$$\frac{1}{17 \times 32}$$

The ratio between the gears 28 and 29 being 1 to 4, the angular difference between the adjusting shaft 27 and the actuating shaft 11 is

$$\frac{1}{4 \times 17 \times 32}$$

The screw thread 19 has a pitch of 16 per inch and the drive gear 20 sixteen teeth in the portion thereof corresponding with the 180 degrees through which the tuning shaft 21 is movable. Consequently the angular difference on the tuning shaft in effecting adjustment thereof is reduced to

$$\frac{180^\circ}{16 \times 4 \times 17 \times 32} \text{ equals } 20''$$

What we claim is:

1. A device for turning a shaft through variable predetermined angles comprising an abutment on said shaft, a rotatable toothed drive member movable relative to said shaft, means associated with said drive member and engageable with said abutment for turning said shaft, a rotatable and axially reciprocable actuating member, and teeth on said actuating member meshing with said toothed drive member, the teeth on said actuating member being inclined whereby during rotary movement of the actuating member the drive member is cammed to vary the degree of rotation of the drive member with relation to the abutment.

2. A device for turning a shaft through variable predetermined angles comprising an abutment on said shaft, a rotatable toothed member movable relative to said shaft, means associated with said drive member and engageable with said abutment to impart rotary movement to said shaft, a rotatable and longitudinally movable actuating member having a screw thread meshing with the teeth of said toothed member whereby upon longitudinal movement of the actuating member the toothed member is turned through a relatively wide fixed angle to impart rotary movement to said shaft whereas when said actuating member is rotated, the toothed member is cammed by the screw thread and turned through a relatively small angle for adjusting the movement of the toothed member with respect to said abutment.

3. A device for turning a shaft through variable predetermined angles comprising a rotatable and reciprocable actuating member having a

5

screw thread, a rotatable drive member movable relative to said shaft, said drive member having teeth meshing with the screw thread and being settable thereby in selected angular positions with respect to said shaft by rotation of said actuating member, said drive member, when set, being rotatable through a fixed angle by said thread during reciprocation of said actuating member; and an abutment on said shaft engageable by means associated with said drive member for imparting rotary movement to said shaft in one direction.

4. A device as claimed in claim 3 provided with means to releasably lock the actuating member at the limit of its reciprocating movement during which said setting movement is imparted to said shaft.

5. A device as claimed in claim 3 provided with means to releasably lock the actuating member at the limit of its reciprocating movement during which said setting movement is imparted to said shaft, and means for retaining the actuating member in adjusted angular position.

6. A device as claimed in claim 3 provided with means for angularly adjusting said actuating member.

7. A device as claimed in claim 3 provided with means for angularly adjusting said actuating member, and means for locking said actuating member in adjusted angular position.

8. A device as claimed in claim 3 provided with a member for locking said actuating member in adjusted angular position, a plurality of teeth on said locking member, and a plurality of recesses arranged to receive the locking teeth singly in various angular adjustments of said actuating member.

9. A device as claimed in claim 3 provided with a member for locking said actuating member in adjusted angular position, a plurality of teeth on said locking member, a plurality of recesses arranged to receive the locking teeth singly in various angular adjustments of said actuating member, the number of locking teeth being prime to the number of recesses.

10. A device as claimed in claim 3 provided with releasable locking means settable in various an-

6

gular positions, and a manually operable reduction gear connecting said locking means with said actuating member operable when said locking means is released to angularly adjust said actuating member.

11. A device as claimed in claim 3 provided with releasable locking means settable in various angular positions, a manually operable reduction gear connecting said locking means with said actuating member operable when said locking means is released to angularly adjust said actuating member, and means to compensate for lost motion in said reduction gear.

12. A device as claimed in claim 3 provided with means tending to rotate said shaft in the opposite direction and preventing backlash of said shaft.

13. A device as claimed in claim 3 wherein said screw thread constitutes the teeth of a rack operable during reciprocation of the actuating member to coact with the teeth of and rotate said drive member.

14. A device as claimed in claim 3 provided with means yieldably retaining said drive member in a fixed position axially of said shaft.

15. A device as claimed in claim 3 provided with means yieldably retaining said drive member in engagement with said abutment to determine the position of said drive member axially of said shaft.

16. A device as claimed in claim 3 wherein said actuating member is constituted by a manually operable push button.

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