June 26, 1945. R. W. MAY 2,378,941

LOCKING BAR STOP MEANS

Filed May 20, 1943 2 Sheets-Sheet 1

Fig. 1.

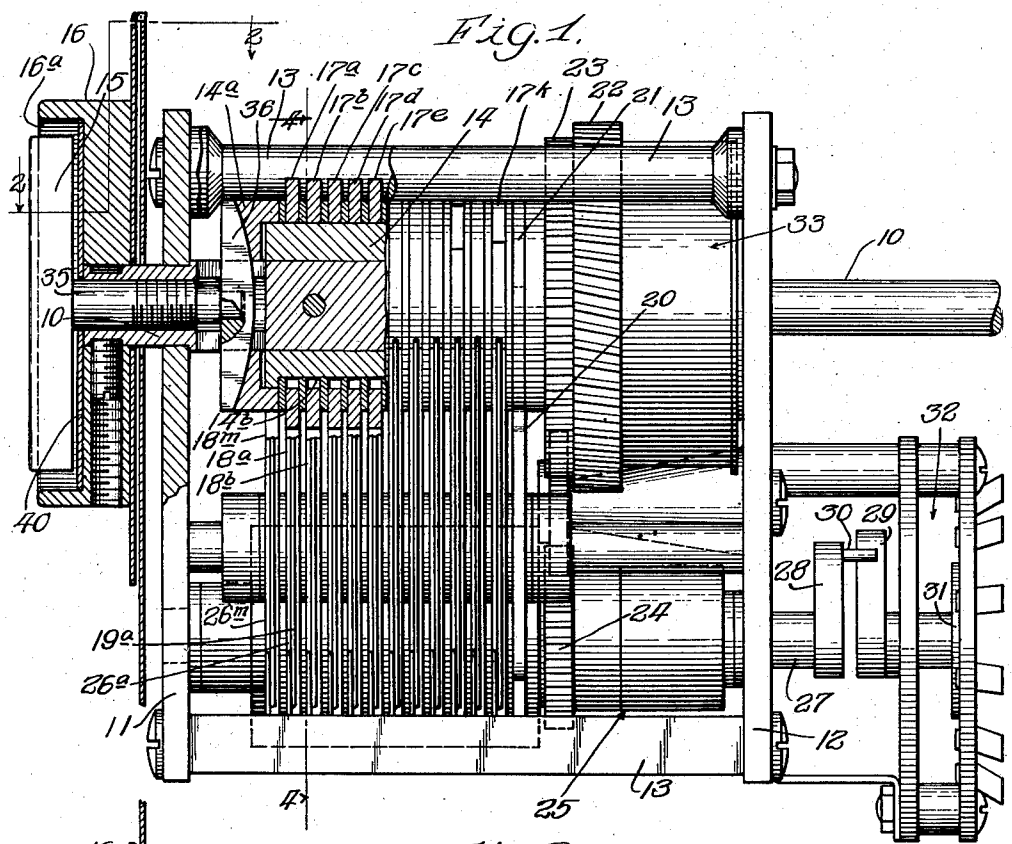
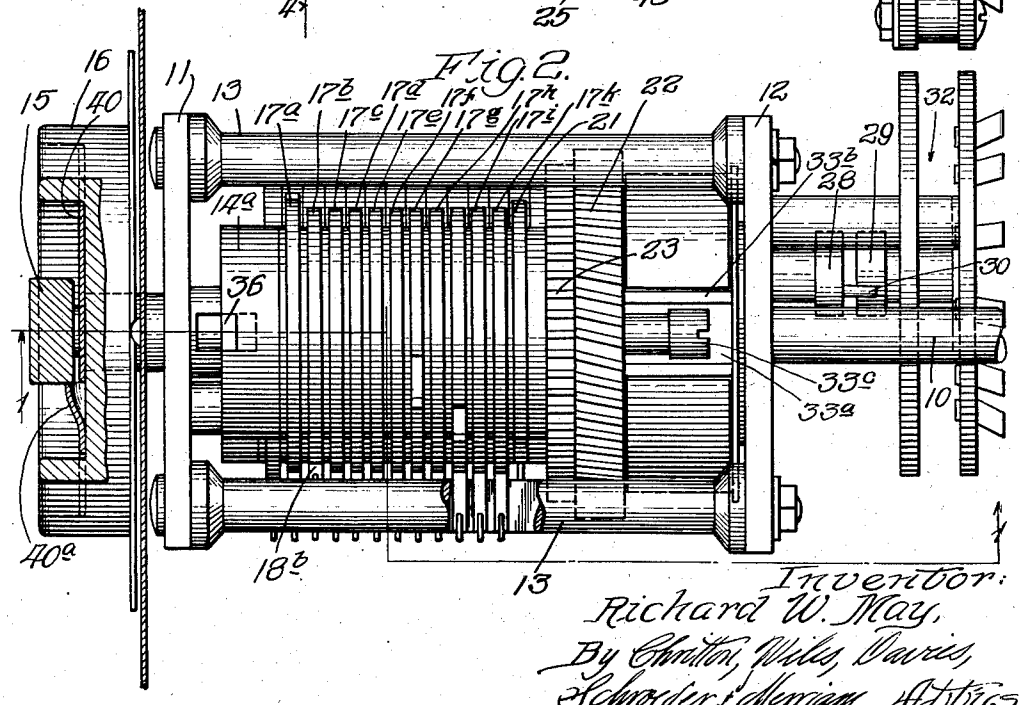


Fig. 2.



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Fig. 3.

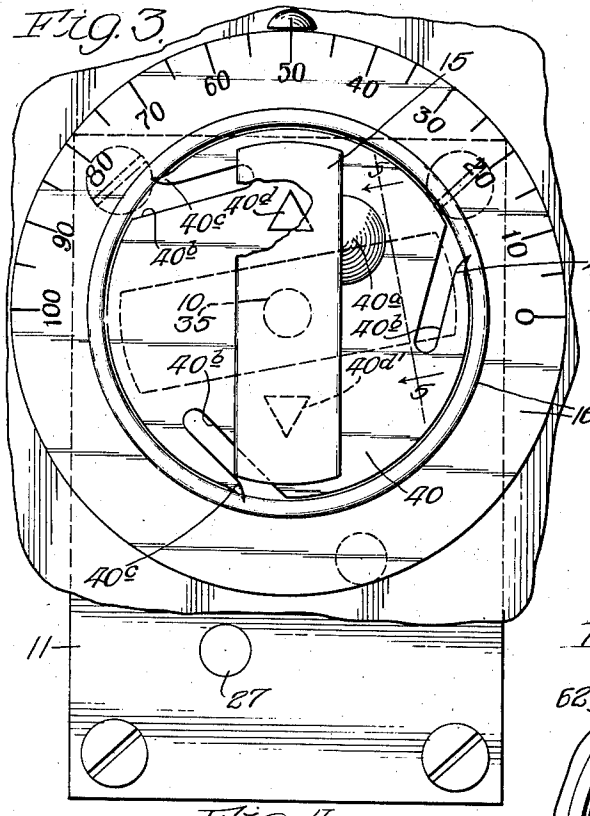


Fig. 5.

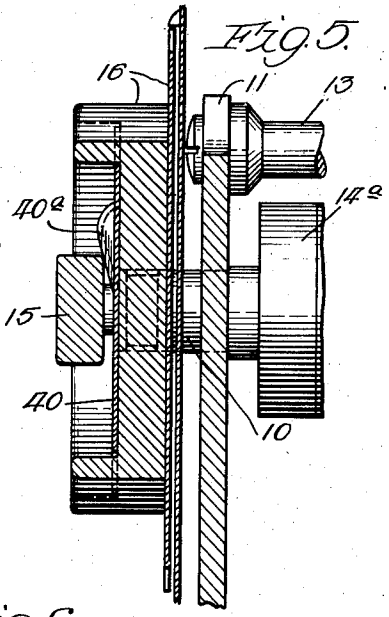


Fig. 6.

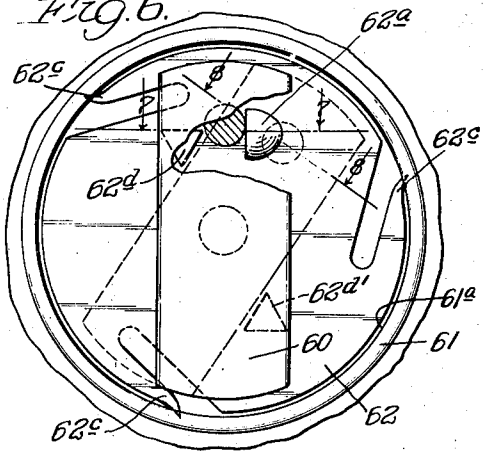


Fig. 4.

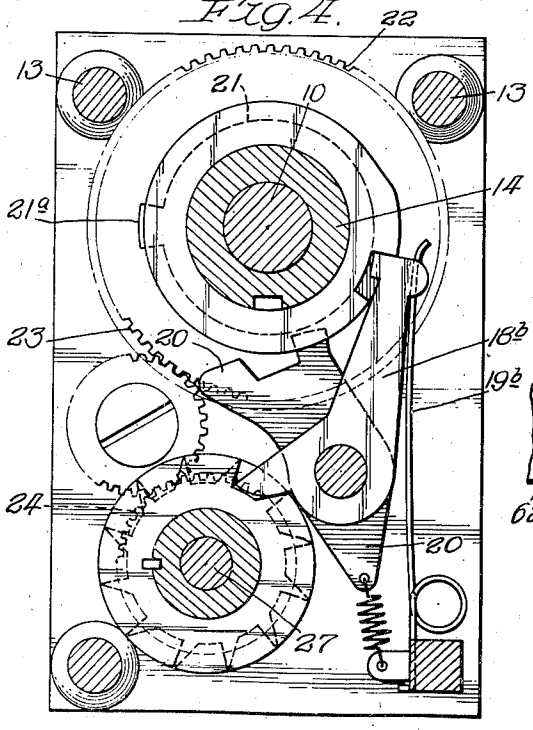


Fig. 7.

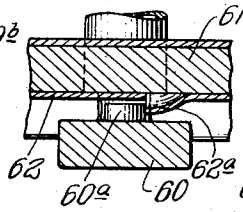
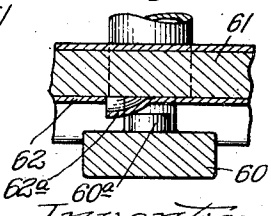


Fig. 8.



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LOCKING BAR STOP MEANS

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Application May 20, 1943, Serial No. 487,728

10 Claims. (Cl. 74—10)

This invention relates to a locking bar stop means, and more especially to stop means particularly adapted to be associated with means manually operable from the front of the panel of a radio set for locking and unlocking stop members of an automatic tuning device to provide convenient means for predetermining the shaft positions selectable automatically.

One feature of this invention is that it provides stop means particularly adapted to be associated with manually rotatable means mounted in the center of a recessed radio dial; another feature of this invention is that any wear in the stop members and associated parts is taken up and compensated for automatically and conveniently; still another feature of this invention is that while there is an automatic follow-up action to ensure tight clamping or locking of the stop members despite wear, the actuating member for the locking means is always limited to a predetermined desired unlocking movement from its locking position; and yet another feature is that the stop means embodying this invention is compact, simple, and easily manufactured and assembled. Other features and advantages of this invention will be apparent from the following specification and the drawings, in which:

Figure 1 is a side elevational view, partly broken away, of an automatic tuning unit embodying this invention; Figure 2 is a plan view, also partly broken away, of the unit shown in Figure 1; Figure 3 is a front elevational view of the unit; Figure 4 is a transverse sectional view along the line 4—4 of Figure 1; Figure 5 is a partial sectional view along the line 5—5 of Figure 3, showing the locking bar at the limit of its unlocking movement; Figure 6 is a view of a modified form of the locking bar and stop means; Figure 7 is a fragmentary sectional view along the line 7—7 of Figure 6; and Figure 8 is a fragmentary sectional view along the line 8—8 of Figure 6, showing the locking bar at the limit of its unlocking movement.

The invention of the present application is directed to stop means for limiting the movement of the locking bar or manual actuating member for means for releasably locking in place stop members rotatably mounted on the main shaft of a tuning device. The particular form of tuning device illustrated herewith is the subject matter of other co-pending applications directed to other features, more particularly Arthur A. Collins application No. 472,717, filed January 18, 1943, and application No. 483,899, filed April 21, 1943, and my co-pending application Serial No. 487,305, filed May 17, 1943.

The unit illustrated here is an improvement in automatic tuning devices of the kind shown in various patents heretofore issued to said Arthur A. Collins, as for example, Collins Patent No. 2,285,414, which issued June 9, 1942. In automatic tuning devices of this type the tuning element shaft is connected to a drum on which are rotatably mounted a plurality of stop rings having stop shoulders adapted to cooperate with a plurality of pawls. There are a similar number of pawls and stop rings, each combination providing a stop assembly adapted to automatically stop the shaft at any predetermined position by engagement of the stop shoulder with the cooperating pawl.

In operation, a drive motor, through appropriate intermediate connections usually incorporating a line shaft, rotates the stop ring drum in one direction until the drum has reached a terminal position where it stops, the drive then continuing operation further (slipping a clutch provided for this purpose) until a selector cam drum and a selector switch reach a position determined by the electrical circuit selected. Thereupon the drive motor reverses and the drum and tuning shaft are driven in the other direction until the operative pawl (selected by the position in which the selector cam drum stopped) engages the stop shoulder of its cooperating ring, whereupon the tuning shaft is stopped at the desired position. The drive motor and driving connections again continue rotation (through the action of the slip-clutch) until they have completed their cycle of operation, controlled by a limit switch.

In operation the stop rings must, of course, be fixedly mounted in desired position on the stop ring drum, and means must be provided for locking them in such position. When it is desired to change the selection of frequencies to which the set is automatically tunable, the stop rings must be released and permitted rotational movement on the drum to enable setting of the new position. This has heretofore been accomplished by providing means carried by and rotatable with the stop ring drum which releasably clamps the rings in place. More recently, a novel means has been provided for operating this releasable locking means, as shown and claimed in said Collins application 472,717, this means including an actuating member or locking bar mounted on the front of the tuning dial. Provision of stop means for limiting the movement of this locking bar presented certain problems, however, and it is these

which are solved by the invention here being disclosed and claimed.

Generally speaking, the present invention comprises a thin metal plate adapted to be interposed between the locking bar and the bottom of a circular recess in the face of the dial. This plate is provided with a stop portion adapted to be engaged by the actuating member at each end of the desired limits of movement thereof; and sharp-pointed tongues cooperating with the side walls of the recess for permitting movement of the stop plate in the direction of locking movement of the actuating bar, but preventing movement in the opposite direction.

Inasmuch as the tuning device unit illustrated here has been described in considerable detail in other co-pending applications directed to other features thereof, it will be described only briefly here, although with sufficient detail to enable understanding of its operation. The present drawings do not include a circuit diagram, since an operative circuit for this unit is shown and fully described in the aforementioned Collins Patent No. 2,285,414; and reference may be had to such patent, or to other previously issued Collins patents on automatic tuning devices, for details of the general operation of devices of the kind shown here.

Figures 1–4 of the accompanying drawings illustrate a unit adapted to automatically position a tuning shaft at any desired point within a single revolution, this unit incorporating one form of my invention in connection with the locking bar actuating the locking means for the stop rings. Referring first to these figures in connection with a general description of the device, it will be seen that the various parts adapted to effect automatic tuning of the shaft of a condenser or other tuning element, as the shaft **10**, are arranged in a self-contained unit mounted between the end plates **11** and **12** held in appropriate relationship by the posts **13**. A drum **14** is fixedly mounted on the shaft **10**, this drum having a longitudinally but non-rotatably movable forward portion **14***a* adapted to be move longitudinally of the shaft by means operative by a manually rotatable bar **15** on the face of the tuning dial **16**. The drum carries any desired number (here shown as eleven) of tuning stop rings, these being here identified as **17***a*—**17***k*. Appropriate non-rotatable spacer washers are provided between these stop rings, both the rings and washers being axially movable on the drum. When the end portion **14***a* of the drum is moved to the left (speaking with respect to the position of the parts as shown in the drawings) the stop rings are loosened and may be individually set to desired positions; and when the end portion **14***a* of the drum is moved to the right the stop rings are clamped and held in the selected positions.

A plurality of tuning positioning pawls **18***a*—*k* and a manual operation pawl **18***m* are provided, the shape and location of the pawls being best seen from consideration of the pawl **18***b* shown in Figure 4. Each pawl has its operating end urged toward the cooperating stop ring by one of a similar number of springs **19**. When a pawl is rendered operative by the selector mechanism to be described, its end drops and rides upon the cooperating stop ring until the slot is reached, whereupon the end drops into the slot and stops the ring (and thus the tuning element shaft **10**), as may be best seen in Figure 4. Stopping of the stop ring drum **14** at either of its two terminal positions, 360° apart, is effected by cooperation between a terminal stop pawl **20** and a stop shoulder **21***a* on a terminal stop ring **21**, this ring being keyed to the drum.

Rotation of the stop ring drum is effected by a drive motor and line shaft having driving connection (through a worm or other appropriate gear, not shown) with the gear **22**. As may be best seen in Figure 4, this gear is mounted coaxially with the shaft **10**, but it is freely rotatable about such shaft. It is rigidly connected to a gear **23** which operates, through an appropriate idler gear shown in Figure 4, to drive the gear **24** which is the driving element of a single-tooth ratchet indicated in general as **25**. This ratchet provides a one way driving connection for rotating the selector cam drum carrying a plurality of tuning position selector cams **26***a*—*k* and a manual tuning selector cam **26***m*. These cams are 12 in number, and have depressions in their peripheries, the arrangement being such that the depressions are equally spaced (as may be best seen in Figure 4) so that they form a helix around the selector cam drum. The selector cam drum is rigidly mounted on a shaft **27**, the other end of this shaft (as may be best seen in Figure 1), making a lost motion connection (through arms **28** and **29** and pin **30**) with the central or rotatable member **31** of the selector switch or tap switch indicated in general as **32**.

In operating the device to automatically select a new tuning position, the operator selects a certain circuit by a manually rotatable switch, a telephone type dial switch, or any appropriate means. A motor relay starts the drive motor and drives the gear **22** in a direction such as to rotate the drum counterclockwise (as it is viewed in Figure 4) until it is stopped in terminal position by engagement between the stop shoulder **21***a* and the stop pawl **20**. The drive then continues, further rotating the selector cam drum and selector switch, until the rotatable portion of the selecter switch reaches the contact or tap corresponding to the selected circuit, whereupon the circuit is opened and relay operation causes the motor to reverse. The drive is then in such a direction that the stop ring rotation is clockwise (as viewed in Figure 4), the selector drum being left standing at the selected position through idling action of the ratchet **25**, this ratchet being operative to drive the selector cam drum only in the first-mentioned direction. When the selected stop combination reaches the position shown in Figure 4, the stop ring drum and tuning element shaft **10** are positively stopped by engagement of the stop shoulder with the pawl, the motor continuing until a limit switch finally stops it.

In order to enable this over-running action of the drive at both ends of movements of the stop ring drum, a slip-clutch is provided in the driving connection between the gear **22** and the shaft **10**, this clutch being here identified in general as **33**. A drum **33***a* mounted on the shaft **10** is encircled by an annular friction unit including the shoe **33***b* of fiber or other non-metallic material, the ends of this shoe being spaced. In the space thus provided lies a stud **33***c* mounted in the gear **22**. Rotation of the gear **22** causes the stud to abut against one or the other ends of the friction unit and rotate the shaft **10** (and the stop rings) until positive engagement of one of the rings with cooperating stop means exceeds the torque transmissible through the clutch, whereupon it slips to permit the further drive necessary at each end of the cycle of operation.

Referring now more particularly to Figure 1,

the broken away portion of the view shows that the stop rings 17 are rotatable on the drum 14; while the intermediate spacing washers are keyed to this drum by portions lying in the slot 14b. The locking bar 15 comprises the actuating end of a stud having the shaft portion 35 threaded into an opening in the shaft 10. The inner end of the threaded shaft 35 is received in a recess in and bears against a pressure member 36 slidably but non-rotatably movable with respect to the shaft 10, this member bearing against the movable end 14a of the stop ring drum. It will be apparent that, with right-hand threads on the shaft portion 35, rotation of the locking bar 15 clockwise (speaking with respect to Figure 3) forces the end 14a of the drum to the right (speaking with respect to Figure 1) and clamps the stop rings in position, these rings being effectively locked in place as the locking arrangement is drawn up tight. When it is desired to change the position of one or more of the rings, it is only necessary to back the locking bar off in unlocking direction (counterclockwise as shown in Figure 3), whereupon the clamping pressure is sufficiently released to enable the rings to be changed to new positions. This is readily done by actuating the automatic tuning mechanism so that the device goes through its cycle and the particular stop combination to be changed ends in the positions shown in Figure 4. It is then only necessary to loosen the locking bar and manually rotate the shaft 10 by use of the dial 16, this being easily done by application of sufficient force to exceed the resistance of the slip-clutch 33. The dial may be initially turned in either direction, but should finally be brought up to the desired position with clockwise rotation so that the stop shoulder of the ring abuts the cooperating end of the stopping pawl, as shown in Figure 4. It is then only necessary to hold the dial in position with one hand and tighten the locking means again by rotation of the locking bar with the other hand.

It is undesirable to have more than a very limited releasing rotation of the locking bar 15. Excessive outward rotation of the locking stud may let the end rings get out of the plane of their cooperating pawls, may let the pressure member 36 drop out, or may let other difficulties arise. I have found that with threads of any reasonable pitch (as 15 to the inch) on the shaft portion 35 of the locking stud, unlocking rotation of from a quarter to a half turn is sufficient. It is not possible to merely place a limiting stop on the dial, however, since wear on the threads, the stop rings, and other parts require the locked position of the locking bar 15 to change if a firm clamping action is to be effected after much usage of the device. Accordingly, some means must be provided which will follow the locking bar as it is drawn up to new locking positions, and which will always automatically limit the unlocking movement to a predetermined amount of rotation from the locked position.

Referring now more particularly to Figures 1, 2 and 3, it will be seen that the dial 16 is provided with a circular recess 16a within which the locking bar 15 is principally received, in locking position, and within which it is rotatable. Interposed between the locking bar and the bottom of this recess is a thin metal stop plate 40, best seen in Figure 3. The plate is circular, with a diameter very closely approaching that of the wall of the recess 16a, so that the plate is just received therein. It is centrally perforated, of course, to permit the threaded shaft portion of the locking stud to pass through it.

Part of the plate is stamped up in a projection 40a generally resembling a quarter section of a sphere providing the stop means adapted to be engaged by the locking bar at the limits of its desired movement. The relation of the parts in locked position is shown in solid lines in Figure 3, the limit of movement of the locking bar in unlocking direction being shown in dotted lines. It will be noted that the engagement between the locking bar and the stop means 40a is what may be termed "square" in the locking direction, as may be seen best in Figure 2; whereas it is what may be termed the "wedging" type in the unlocking direction as may be best seen in Figure 5. The square engagement upon locking movement of the bar 15 facilitates rotation of the locking plate 40 to a new position as the parts wear; whereas the wedging action at the limit of unlocking movement forces the plate down against the bottom of the recess and assists means at the edge of the plate, which will now be described, in preventing rotation of the plate in the unlocking direction.

As may be best seen in Figure 3, the edges of the plate have a plurality of slots 40b stamped therein, these lying at a considerable angle to radii through their outer ends. This provides a plurality of sharp pointed tongues 40c, and during the manufacture of the plates these tongues are bent or forced outwardly as shown. The dial is preferably made of a plastic such as Bakelite or some other non-metallic material so that the walls of the recess 16a are considerably softer than the material of which the tongues 40c are made. It will be seen that the tongues 40c extend at a considerable angle, and lie back toward the unlocking (counterclockwise in Figure 3) direction of rotation. This provides very effective means for preventing undesired unlocking movement of the locking bar 15, yet enabling the plate to rotate clockwise from time to time as may be necessary to enable taking up of wear in the locking parts, the plate always immobilizing itself at such new position. In assembling the device, it is only necessary to slip the plate over the end of the locking stud and then screw this into the shaft 10, the plate readily moving down into its appropriate final position as shown in the drawings.

In order to reduce the possibility of operating the autotune unit when the actuating bar 15 is in unlocked position, the plate 40 is provided with some different and attention-catching portion which is covered when the actuating bar is in locked position, but uncovered and visible when the bar is in unlocked position. In the particular case shown here, this comprises arrowheads or triangles 40d and 40d', printed in some distinguishing color, as red on a black background. As may be best seen in Figure 3, these are so positioned that they are covered and not visible when the actuating bar 15 is in locked position in engagement with the stop portion 40a; but are fully visible and attention-catching when the bar is in unlocked position as shown in dotted lines.

A modified form of this invention is illustrated in Figures 6, 7 and 8. The locking bar 60 is again rotatable in a recess 61a in a dial 61, a locking plate 62 again being interposed between the locking bar and the bottom of the recess. In this modification, the locking bar is slightly wider, and provided with an inwardly extending shoulder portion or stud 60a. The locking plate is again provided with sharp pointed tongues 62c, and a

stop portion 62*a* generally resembling a quarter section of a sphere. A stud portion of the locking bar again abuts squarely against the stop portion 62*a* of the plate in the locking direction of movement, as may be seen in Figure 7; and again has a wedging action in the unlocking direction, as is shown in Figure 8. The particular advantage of this form of my invention is that, in locked position, the stop portion of the plate is hidden by the locking bar. This arrangement also provides a substantially greater arc of movement approaching a half circle, locked position being shown in solid lines in Figure 6 and unlocked position in dotted lines in the same figure. Indicating means are again provided, these being the arrowheads or triangles 62d and 62*d'*, in a color clearly distinguishing from that of the plate 62. As will be best noted in Figure 6, it will be seen that these are also so positioned that they are covered when the actuating bar 60 is in locked position, but uncovered and visible when the bar is in the unlocked position shown in dotted lines.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. In a tuning device for automatically positioning a rotatable shaft, wherein the tuning device has a plurality of stop members movably mounted on said shaft and adapted to make engagement with cooperating stop means, means for releasably locking the members in desired position on the shaft, and an actuating member for operating the locking means, means for limiting the movement of the actuating member, including: stop means adapted to be engaged by the actuating member at each end of the desired limits of movement thereof; and means permitting movement of the stop means in the direction of locking movement of the actuating member but preventing movement thereof in the opposite direction.

2. Apparatus of the character claimed in claim 1, wherein the actuating member, stop means, and last mentioned means are mounted on and normally rotatable with said shaft.

3. In a tuning device for automatically positioning a rotatable shaft having a dial on one end thereof, wherein the tuning device has a plurality of stop members movably mounted on said shaft and adapted to make engagement with cooperating stop means, means for releasably locking the members in desired position on the shaft, and an actuating member for operating the locking means, this member being mounted on said dial and rotatable about the same axis, means for limiting the movement of the actuating member, including: stop means adapted to be engaged by the actuating member at each end of the desired limits of movement thereof, this means being mounted on the dial and rotatable about said axis; and means permitting movement of the stop means in the direction of locking movement of the actuating member but preventing movement thereof in the opposite direction.

4. In a tuning device for automatically positioning a rotatable shaft having a recessed dial on one end thereof, wherein the tuning device has a plurality of stop members movably mounted on said shaft and adapted to make engagement with cooperating stop means, means for releasably locking the members in desired position on the shaft, and an actuating member for operating the locking means, this member being mounted in the recess of said dial and rotatable about the same axis, means for limiting the movement of the actuating member, including: stop means adapted to be engaged by the actuating member at each end of the desired limits of movement thereof, this means being mounted in said recess and rotatable about said axis; and means permitting movement of the stop means in the direction of locking movement of the actuating member but preventing movement thereof in the opposite direction.

5. In a tuning device for automatically positioning a rotatable shaft, manual means for rotating said shaft and for releasably locking a plurality of stop members movably mounted on said shaft and adapted to make engagement with cooperating stop means, including: a non-metallic dial having a circular recess in its face concentric with its axis of rotation; an actuating member mounted in said recess and rotatable about said axis; and a metal plate interposed between said actuating member and the bottom of the recess, said plate having a portion adapted to be engaged by the actuating member to limit the movement thereof, and portions at the edge of the plate engaging the wall of said recess, this engagement permitting movement of the plate in the direction of locking movement of the actuating member but preventing movement thereof in the opposite direction.

6. Apparatus of the character claimed in claim 5, wherein the portions at the edge of the plate comprise sharp-pointed tongues so pointed as to bite into the wall of the dial recess in only one direction of rotation of the plate.

7. Apparatus of the character claimed in claim 5, wherein the portion adapted to be engaged by the actuating member is so formed as to have one engaging surface perpendicular to the bottom of the recess and another surface, the surface engaged upon unlocking movement of the actuating member, at an acute angle with respect thereto.

8. Apparatus of the character claimed in claim 5, wherein the portion adapted to be engaged by the actuating member is completely covered by the actuating member in the locking position thereof.

9. Apparatus of the character claimed in claim 5, wherein the plate includes an indicating portion so positioned as to be covered by the actuating member when it is in locked position but visible when the actuating member is in unlocked position.

10. Apparatus of the character described for automatically positioning a rotatable shaft, including: a plurality of stop members movably mounted on said shaft and adapted to make engagement with cooperating stop means; means for releasably locking the members in desired position on the shaft; a movable actuating member for operating the locking means; and means for indicating when said actuating member is in unlocked position.

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