

June 22, 1943.

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2,322,387

AUTOMATIC TUNING MECHANISM FOR RADIO RECEIVERS

Filed Nov. 8, 1940

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Fig. 1

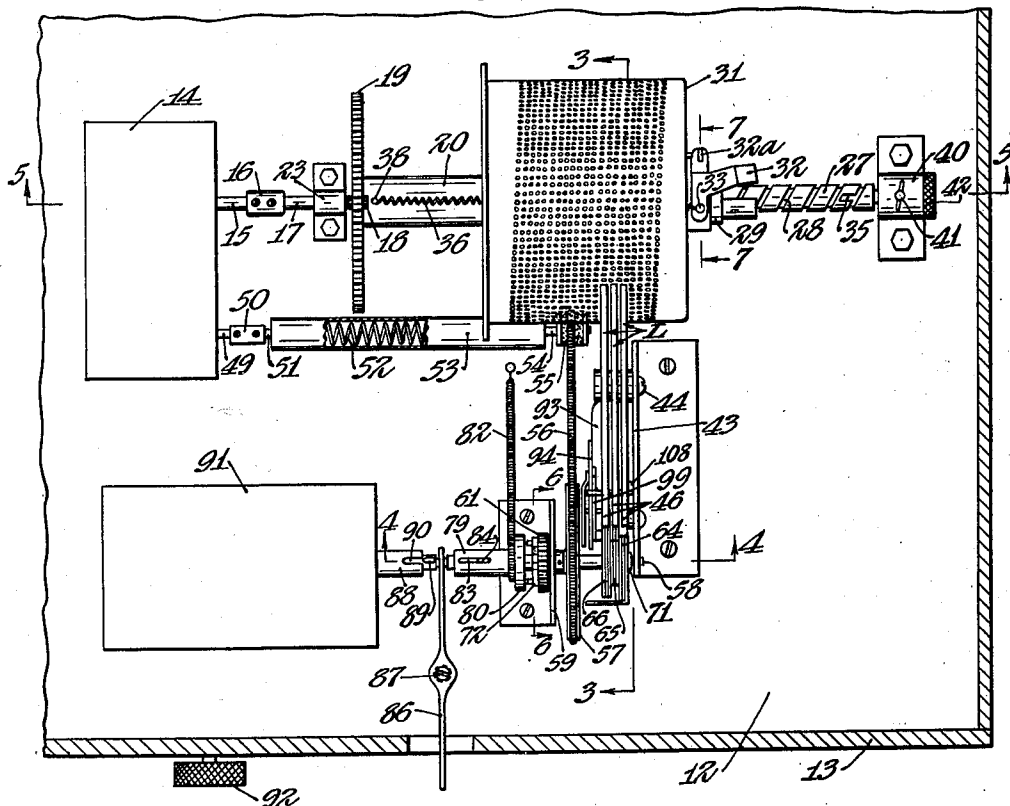
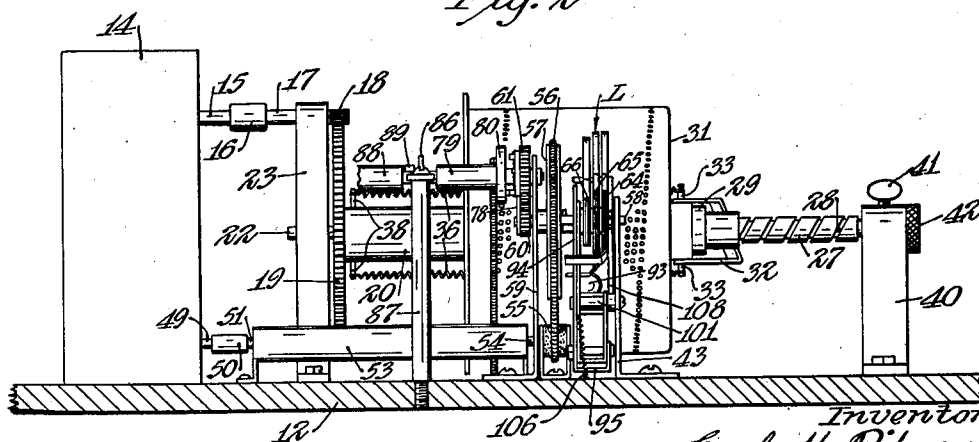


Fig. 2



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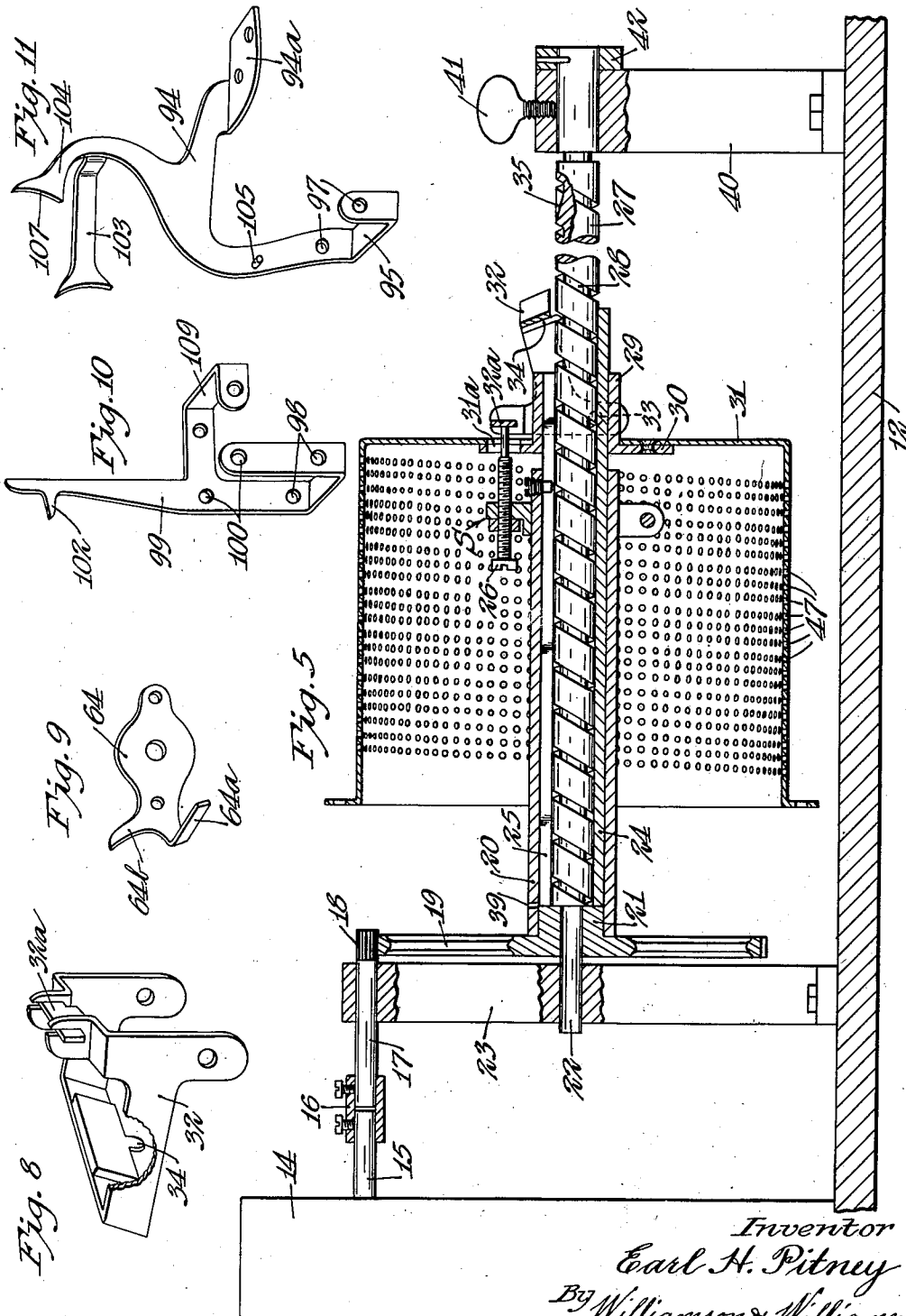
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UNITED STATES PATENT OFFICE

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AUTOMATIC TUNING MECHANISM FOR
RADIO RECEIVERS

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10 Claims. (Cl. 250—20)

This invention relates to automatic tuning apparatus for radio receivers and is adapted for the automatic energization of the receiving circuit as well as selection of desired stations throughout a complete cycle of tuning operations, such as a series of programs throughout a week wherein the series is repeated in succeeding weeks.

This invention is generally similar to that disclosed and claimed in my prior Patent Number 2,172,623, granted September 12, 1939. However, certain additional features and improved features are included herein.

One of the objects of my invention is to provide energy for rapidly manipulating the tuning element of the radio receiver which is derived from a single low powered control clock and stored until actuation of the tuning element is desired.

Another object of the invention is to provide safety means in the form of a frictional drive connection between the energy storage device and the tuning element to prevent too much energy from accumulating in said storage device.

A further object of the invention is to provide high accuracy timing control for the tuning element and have the mechanism simple, positive and inexpensive to manufacture.

Still another object of the invention is to provide improved means for stopping the tuning element at the desired point and simultaneously controlling the main switch of the receiver circuit.

Another object of the invention is to provide flexibility and ease of tuning whether automatic or manual with the minimum of disturbance to the permanent program schedule when operating manually.

Another object of the invention is to provide a control drum or unit which is actuated by combined rotary and reciprocating movement with improved reset means and means for cushioning the control drum during the resetting operation.

These and other objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same parts throughout the views, and, in which:

Fig. 1 is a general plan view of my invention with the tuning element of its cooperative radio receiver shown more or less diagrammatically;

Fig. 2 is a side elevation thereof;

Fig. 3 is an enlarged section taken approximately on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged section taken approximately on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged longitudinal section taken approximately on the line 5—5 of Fig. 1;

Fig. 6 is an enlarged section taken approximately on the line 6—6 of Fig. 1;

Fig. 7 is a section taken approximately on the line 7—7 of Fig. 1;

Fig. 8 is an enlarged perspective view partially broken away of the screw follower;

Fig. 9 is a perspective view of one of the stop arms;

Fig. 10 is a perspective view of the combined stop arm lock; and

Fig. 11 is a perspective view of the switch actuator.

In the drawings there is shown a suitable base 12 at one edge of which is a vertical panel 13. A constant speed power device such as an electric clock is mounted on the base as indicated generally at 14. A drive shaft 15 which may be an extension of the minute hand shaft of the clock 14 extends rearwardly from the clock and is connected by means of a suitable coupling 16 to a shaft 17 having a pinion 18 on its free end. The pinion meshes with and is adapted to drive a large gear 19 on a sleeve member 20 (Fig. 5). The sleeve is pressed onto the hub 21 of gear 19 as viewed in Fig. 5 and through this hub as a bearing projects a stub shaft 22 which is part of shaft 27. Shafts 17 and 22 are journaled in a suitable bracket 23. Fitted within the sleeve member 20 is a sleeve 24 which has a longitudinal slot 25 extending throughout its length. A suitable key 26 extends through the sleeve 20 and is adapted to ride in the slot 25 of sleeve 24 so that the two sleeves can be moved longitudinally relative to each other. Mounted within the inner sleeve 24 is a shaft 27 having a screw 28 formed therein and the screw is provided with threads for reasons to be seen below.

A collar 29 having a flange 30 is secured on the right-hand end of the inner sleeve 24 and the flange 30 has a drum 31 secured thereto. A screw follower 32 is pivotally connected to the collar 29 on the sleeve 24 by pivot pins 33. The follower, as best shown in Fig. 8, is formed of two side portions and a connecting cross member, the latter of which carries a pin 34 which is adapted to fit into the screw 28.

As the outer sleeve 20 is rotated by its gear connection with the electric clock 14 the sleeve 24 will also be rotated due to its splined connection with the outer sleeve 20 and the drum 31 will be rotated causing the screw follower to pull the drum toward the right and at the same time permitting the inner sleeve 24 which supports the

drum to move because of its splined connection with the outer sleeve 20.

As shown in Figs. 1 and 5 the end of the screw 28 has an inclined slot or ramp 35 communicating therewith. The position of the ramp as shown in Fig. 5 indicates that the right-hand end thereof is approximately as deep as the screw 28 and thence slants upwardly to the outer surface of the shaft 27. As shown in Figs. 1 and 2, a pair of tension springs 36 are connected between the pins 33 which are the pivot pins of the pivoted screw follower 32 and at their other ends to pins 38 on the left-hand end of the outer sleeve 20. These springs, of course, exert a pulling tension on the drum 31 toward the left and when the drum has traveled along the threaded shaft 27 and the follower pin 34 comes to the ramp 35 the springs 36 will pull the drum to the left so that the pin 34 will ride up the ramp. The screw follower 32 is so arranged that when it is elevated by the ramp 35 it will remain in its elevated position due to friction, and the drum 31 and inner sleeve 24 will be quickly returned to the left-hand end of the threaded shaft 27 for a repeat operation. A small bleeder opening 39 is provided in the left-hand end of the outer sleeve 20 and it is of such size that the return of the inner sleeve 24 to the left between the shaft 27 and outer sleeve 20 will cause a pocketing of air to produce a cushioning effect and prevent inner sleeve 24 from striking the hub 21 in the outer sleeve 20 with undesirable force.

Mounted on the right-hand end of the outer sleeve 20 is an adjustable threaded stop member S which has a portion projected to the right through an aperture 31a in the end wall of the drum 31 so that when the drum is returned to the left under action of the springs 36 the stop member S will strike a cross piece 32a on the upper portion of the screw follower 32 causing said follower to tilt downwardly to the right and the follower pin 34 to re-enter the screw 28 on the shaft 27.

The right-hand end of the shaft 27 is mounted in a bracket 40 and held by a set screw 41. This makes it possible to loosen the set screw and by rotating the knurled knob 42 shift the whole drum assembly laterally to provide adjustments which might be necessary.

Supported by an upstanding bracket 43 (Fig. 1) is a short pivot shaft 44 which pivotally supports a plurality of levers L (Fig. 4) which have forward extensions 45 (Fig. 3) and rearward extensions 46. The circular wall of the drum 31 is provided with rows of helically arranged apertures 47 (Fig. 5) which are adapted to receive a plurality of removable partially split pins 48 (Fig. 3). There are three levers L shown in Figs. 1 and 4, and there are also three rows of helically arranged apertures 47. The pins 48 can be inserted in the apertures 47 and secured therein by friction due to their split construction and the spaces between the apertures in a row are preferably such that they represent the rotational movement of the drum 31 through a fifteen minute interval. As a result if a single pin is inserted in one of the rows of apertures 47 the drum will rotate until the pin is brought up beneath the end 45 of one of the levers L with which one of the rows of apertures cooperates and the right-hand end 45 of that lever will be raised against the action of the tension spring 45a and retain it in its raised position through a fifteen minute interval. This, of course, will depress the left-hand end 46 of said lever L.

Returning to the electric clock mechanism 14 there is shown a shaft 49 connected by a suitable coupling 50 to a shaft 51 which is secured to one end of a helical spring 52, said spring being mounted in a casing 53. The right-hand end of the spring 52 is connected to a shaft 54 which has a pulley 55 mounted thereon. The pulley 55 is connected by means of a resilient sprocket chain 56 of spring construction to a larger pulley 57 (Fig. 4) mounted on shaft 58 for rotation therewith. The shaft 58 is supported for rotation by the bracket member 43 at one end and by the vertical bracket 59 at its other end. The left-hand end of shaft 58 carries a gear 60 which is meshed with and adapted to drive a larger gear 61 on a rotatably mounted shaft 62 which is supported for rotation between the vertical bracket 59 and the shaft of the tuning condenser of a radio receiving set.

Adjacent the right-hand end of the shaft 58 are three stop arms 64, 65, and 66. The arm 64 is shown in perspective in Fig. 9. Arms 65 and 66 are similar in structure except that the offset portion 64a of the stop member 64 is longer than those on the stop members 65 and 66, and the offset on the stop member 66 is the shortest one of the three. Each of the stop members has a friction disc 67 placed thereagainst and also a plate 68 which lies against the other side of the friction disc 67. The plates 68 are connected by screws 69 to clamp the frictional discs 67 between them. A shoulder 70 on the shaft 58 limits inward movement of the friction discs and their spacers on the shaft and a left-hand nut 71 clamps these to the shaft and allows individual positioning of the stop arms to be made after loosening screws 69. Each of the stop arms 64, 65 and 66 is provided with an extension 64b, 65b and 66b and they are of such length that when their respective lever L is depressed at its left-hand end by riding of the right-hand end 45 of the lever over one of the pins 48 on the drum 31 the stop arm will contact the left-hand end 46 of the lever L and hold the shaft 58 against rotation.

The gear 61 on shaft 62 has a pair of levers 72 (Fig. 6) pivotally connected to its side face at points 73 and springs 74 each have an end lying behind a pin 75, and said springs then extend around the pivot pins 73 and their opposite ends lie behind posts 76, end portions of which are cut away to provide for projections 77. The springs 74 are so arranged that they will tend to swing the levers 72 in a counterclockwise direction and the ends 72a of said levers 72 bear against the pins 75 to limit pivotal movement of said levers. A lever operating member 78 is fixed on the shaft 58 against a side face of the small gear 60 and 180 degree movement of the larger gear 61 will cause the smaller gear 60 and lever operator 78 to describe a full revolution and bring the operating member 78 into the same relationship with the other of the levers 72.

A sleeve 79 on the shaft 62 carries a wheel 80 from which projects a flat sided pin 81. When the spring levers 72 on the gear 61 are not depressed by the lever operating member 78 the outer ends of the posts 77 on the levers 72 will be in rotational alignment and are adapted to successively abut the flat faced pin 81 on the wheel 80. However, when shaft 58 is rotated the lever operating member 78 will push the proper post 77 out of engagement with the flat sided pin 81 on the wheel 80 and permit the wheel 80 and sleeve 79 to turn back under the influence

of a tension spring 82. This latter rotational movement is in the direction of the arrow shown in Fig. 4. Sleeve 79 is splined to a floating coupling 85 through a slot 83 and spline 84. Coupling 85 has a reduced portion 85a to receive a forked clutch lever 86 which, as best shown in Fig. 1, is pivoted at 87 and extends forwardly through the cabinet panel 13 so that it can be manipulated from outside of the panel. A key 89 on the left end of the coupling 85 is thus made to engage or disengage a notch 90 in the end of the sleeve 88 which is clamped by suitable means to the shaft of the tuning condenser 91 of a radio receiver. In the position shown in Fig. 1 the tuning unit is disconnected. In the position of shaft 85 and the sleeve 88 shown in Fig. 1 the tuning element 91 can be manually operated but is disconnected from the power drive shaft 62.

A mercury switch 93 (Fig. 3) controls the master receiver circuit. It is mounted on a bracket 94 (Fig. 4) which has a substantially U-shaped portion 95 (Fig. 11) and said U-shaped portion has a pin 96 extending between apertures 97 in the opposite arms of said U-shaped portion. The U-shaped lower portion of the bracket 94 receives U-shaped arms in the lower end of the locking member 99 (Fig. 10). The member 99 has a pair of aligned apertures 98 which receive the pivot pin 96. The apertures 100 above the apertures 98 receive a pivot pin 101 which pivotally connects the locking member 99 to the bracket 43, which extends vertically from the base 12.

The locking member 99 has a prong 102 extending outwardly from its upper end and in one position thereof is adapted to lie in the path of movement of the lateral extensions 64a, 65a and 66a on the stop members 64, 65, and 66 so that when the shaft 58 is rotated one of the stop members will be stopped by its respective lever L controlled by the pins 48 on the drum 31. However, when all of the levers L have dropped from their respective pins 58 their left-ends 46 will be out of the path of movement of the projections 64b, 65b and 66b on the stop members 64, 65 and 66. The locking prong 102 will in such case prevent rotation of the shaft 58 due to its contact with one of the stop members, and at the same time act as an accurately controlled trigger when pins 48 again indicate a desired program.

The switch supporting bracket 94 has a switch base 94a to support the mercury switch 93, and it also has a pair of upper arms 103 and 104. The bracket 94 also has a pin 105, and a tension spring 106 is connected between the pin 105 and a suitable point on the base 12 to normally urge the bracket member 94 counterclockwise around its bearing pin 96 and at the same time urge the locking member 99 counterclockwise around its bearing pin 101. If none of the lateral extensions 64a, 65a or 66a is in the path of movement of the upper arm 104, it will swing to the left until upper arm 103 engages the shaft 58 as indicated in Figs. 3 and 4. However, when the shaft 58 is rotated the lateral extension on one of the stop members 64, 65 or 66 will engage the curved edge 107 on the bracket arm 104 forcing said bracket to the right against the tension of spring 106. This will tilt the mercury switch 93 to the right and close the radio receiver circuit.

A curved wirelike member 108 is connected to an offset portion 109 on the locking member 99 and said member extends upwardly and thence at right-angles through notches 46a in the left-hand ends 46 of the levers L, and when said left-hand ends 46 are depressed they will similarly

press downwardly on the member 108 causing an initial swinging of locking member 99 and switch bracket 94 to the right. This initial movement will free the locking member 99 from the path of movement of the stop members 64, 65 and 66 and tilt the mercury switch enough so that the additional tilting given it by the lateral extensions 64a, 65a or 66a engaging the curved edge 107 will cause it to short its terminals.

The apparatus is set for the desired functioning by placing the frictionally held split pins or posts 48 in those of the apertures 47 in the drum 31 which correspond to particular times of particular days when it is desired to operate the receiver on the wave band of a particular station or stations. The identification of the apertures can, of course, be placed upon the drum so that it is a simple matter to arrange the pins 48. The stop members 64, 65 and 66 are rotationally positioned on the shaft 58 in such a manner that the stops are in position to engage their respective levers L when the station for which each stop member is used is properly tuned in on the receiver. The clock shaft 15 will rotate sleeves 20 and 24 causing the drum 31 to move to the right on the shaft 27 as viewed in Fig. 5 and also cause the drum to rotate at such a speed that the apertures 47 in the drum will be brought past a certain spot at fifteen minute intervals. The torsion spring 52 in the casing 53 is also being wound by the clock shaft 49 and rotative energy is built up therein until its reaction is greater than the frictional resistance of spring belt 56 slipping over large pulley 51.

One of the stop members 64, 65 or 66 will be in a locked position in abutment with the angular extension 102 on the locking member 99 so that the shaft 58 cannot rotate. When the drum 31 has rotated to bring a control pin element 48 up beneath an end 45 of one of the levers L the left-hand end 46 of said lever L will be depressed. We will assume that it is the lever L which does not correspond with the stop member which is held in locked position by the locking bar 99. Upon depression of the lever end 46 the arcuate member 103 will depress the lateral extension 109 on the locking member 99 and cause displacement of the prong 102 on the locking member 99 to free the stop member 64, 65 or 66 which has been held by said locking prong 102. Thereupon the shaft 58 will rotate and the spring lever actuator 78 on said shaft 58 which is shown in Fig. 6 will upon rotation of the meshed gears 60 and 61 cause swinging movement of one of the spring levers 72 so that one of the flat ended pins 76 will slide past the flattened pin 81 on the wheel 83. This will permit the tension spring 82 to turn this whole assembly back through approximately 180 degrees and so be put into readiness for forward rotation, and with the clutch lever 86 swung to bring the key 89 into the key slot 90 on the tuning element sleeve 88 will rotate said tuning element. Rotational movement of the tuning element is controlled by the proper stop member 64, 65 or 66 coming into contact with the lever arm L which is depressed at its left end 46. Simultaneously with swinging of the stop member against the end of its cooperating lever L one of the lateral extensions 64a, 65a and 66a depending upon the stop member in question will engage the curved edge 107 on the arm 104 of the switch bracket 94 and tilt the mercury switch 93 to energize the receiving circuit.

In many cases the same lever L will be held

up by a row of successive pins 78 with the result that the torsion spring 52 connected to the clock shaft 49 could build up considerable rotative power. To eliminate excess torsional power the large pulley 57 on the shaft 58 as has been stated above has a smooth groove and the resilient belt or sprocket connector 56 will slip upon the pulley 57 so that only a maximum degree of torsion can be built up in said spring 52.

When a switch is made from one station to another the lever L which was previously depressed will slip off the last of the pins 48 in its respective row of apertures 47 and another lever L will begin to ride upon the tops of pins 48 in its row of drum apertures 47, and the action of the shaft 58 and another one of the stop members 64, 65 or 66 will take place as described above.

The drum 31 where the device is intended for a weekly cycle of repetition will require a week's time to run from the left-hand end of the screw shaft 27 to the right-hand end thereof. At the end of a week, however, the screw follower pin 34 will have reached the ramp 35 communicating with the end of screw 28 and springs 36 will quickly return the drum 31 to the left-hand end of the shaft 27 whereupon the cycle will be repeated.

From the foregoing description it will be seen that I have provided an improved apparatus for automatically tuning radio programs wherein the tuning cycle can be repeated time after time. I have provided means for building up energy and so making possible the use of a single low powered control clock 14 by means of the torsion spring 52 and its safety drive connection with the pulley 57 on the shaft 58 so that there is always sufficient power present to rotate the tuning element 91 quickly. I have provided an improved form of screw follower for moving the control drum to the right on the shaft 27 and also improved means for cushioning the return of the drum to the left for another cycle of operation. I have provided efficient and simply operated mechanism for locking the stop members on the shaft 58 as well as means for actuating the lock release and also for completing the electrical circuit to the receiving apparatus.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What is claimed is:

1. In combination with a tuning element of a radio receiver, a rotary shaft adapted to move said tuning element, a rotary power element, means for releasably securing said tuning shaft against rotation and a yieldable drive connection between said rotary power means and said tuning shaft including a driving pulley connected to said rotary power means and a driven pulley connected to said tuning shaft, a flexible belt running over said pulleys and one of said pulleys having a smooth belt receiving groove with a lesser coefficient of friction than the other of said pulleys to permit slippage of said belt upon the exertion of a pre-determined maximum power from said rotary power means.

2. In combination with the tuning element of a radio receiver, a chronometrically rotated shaft, a second shaft splined relative to said first shaft and rotatable therewith, a rotary control unit carried by said second shaft, a fixed screw, a movable member carried by said rotary control

unit and adapted to engage or disengage the threads of said screw and to advance said rotary control unit along said screw in one direction, means for bringing said movable member into engagement with the screw at one extreme position of said control unit, means normally urging said control unit toward said extreme position at one end of said screw, and said screw having a takeout groove at its other end communicating with the end of the screw to permit said movable member to ride out of the screw and return to said extreme position under the influence of said yielding means.

3. The structure in claim 2 and said movable member being pivotally supported by said control unit, and said yielding means for returning said unit to said extreme position being connected to said movable member and normally urging said member into said screw, said takeout means being lying in the path of movement of said movable member to engage and shift said member to a dead center position out of engagement with said screw, and abutment means adjacent the end of said screw at said extreme position of said control unit, said abutment means lying in the path of movement of said movable member to cyclically engage and tilt said movable member from its dead center position and to re-engage with said screw.

4. In combination with the tuning shaft of a radio receiver, power means for imparting movement to said tuning shaft, a movable control unit, a lever adapted to move under the influence of said control unit, a stop member associated with said tuning shaft, a circuit controller connected to said lever, said lever being movable to partially actuate said circuit controller and to swing into the path of movement of said stop means, and an abutment on said stop means and movable therewith to engage and further adapted to operate said circuit controller through the remainder of its circuit making movement, and said lever lying in the path of movement of said stop means to automatically stop said tuning shaft at a pre-determined position.

5. The structure in claim 4 and means for returning said circuit controller to open circuit position upon release of said stop means by said lever under the action of said control unit.

6. In combination with the tuning element of a radio receiver, a tuning shaft adapted to rotate said tuning element, a control unit, a stop lever mounted for pivotal movement adjacent said control unit and movable thereby, and a rotary stop element adapted to rotate with said tuning shaft, said stop element comprising a relatively flat member, a rotary shaft support therefor, a friction plate beside said stop element, a clamping plate of larger surface area than said friction plate, and means for drawing said clamping plate toward said stop member beyond the edge of said friction plate, and means for clamping said plate and stop element securely to their supporting shaft.

7. In combination with the tuning element of a radio receiver, a synchronous motor of pre-determined maximum output, a device connected to said motor for storing up energy from said motor, a tuner actuator having means for releasably locking the same against movement, and a drive connection between said power storing device and said tuner actuator, said tuner actuator having less frictional resistance than said drive connection, said power storing device having sufficient power output to overcome the frictional

resistance of said drive connection when said actuator is locked, and said synchronous motor having a power output greater than the combined resistance of said power storing device, said drive connection and said tuner actuator when the latter is released.

8. In a radio receiver having a tuning shaft rotatable through approximately 180 degrees, power means, and a drive connection between said power means and said tuning shaft including, a pair of rotary elements, one of said rotary elements being located on said tuning shaft and the other of said rotary elements forming part of said drive connection, said rotary elements being interengaged for transmission of power from one to the other, the rotary element on said tuner shaft having a releasable connection with said tuner shaft, said rotary element on said drive connection being related to said rotary element on said tuning shaft in a one to two ratio and having means for engaging said releasable connection upon every full revolution of said drive connection rotary element and upon every half revolution of said rotary element on said tuner shaft to release said tuner shaft rotary element from the tuner shaft, and means for reversing said tuner shaft half a revolution when said releasable connection is thus released.

9. In an automatic control device, a chronometrically rotated shaft, a second shaft splined

relative to said first shaft and rotatable therewith, a rotary control unit carried by said second shaft, a fixed screw, a movable member carried by said rotary control unit and adapted to engage or disengage the threads of said screw and to advance said rotary control unit along said screw in one direction, means for bringing said movable member into engagement with the screw at one extreme position of said control unit, means normally urging said control unit toward said extreme position at one end of said screw, and said screw having a takeout groove at its other end communicating with the end of the screw to permit said movable member to ride out of the screw and return to said extreme position under the influence of said yielding means.

10. In an automatic control device for radio receivers, power means, a movable control unit, an element adapted to move under the influence of said control unit, stop means, a circuit controller connected to said element, said element being movable to partially actuate said circuit controller and to move into the path of movement of said stop means, and an abutment on said stop means and movable therewith to engage and operate said circuit controller through the remainder of its circuit making movement, and said element lying in the path of movement of said stop means.

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