

Nov. 5, 1957

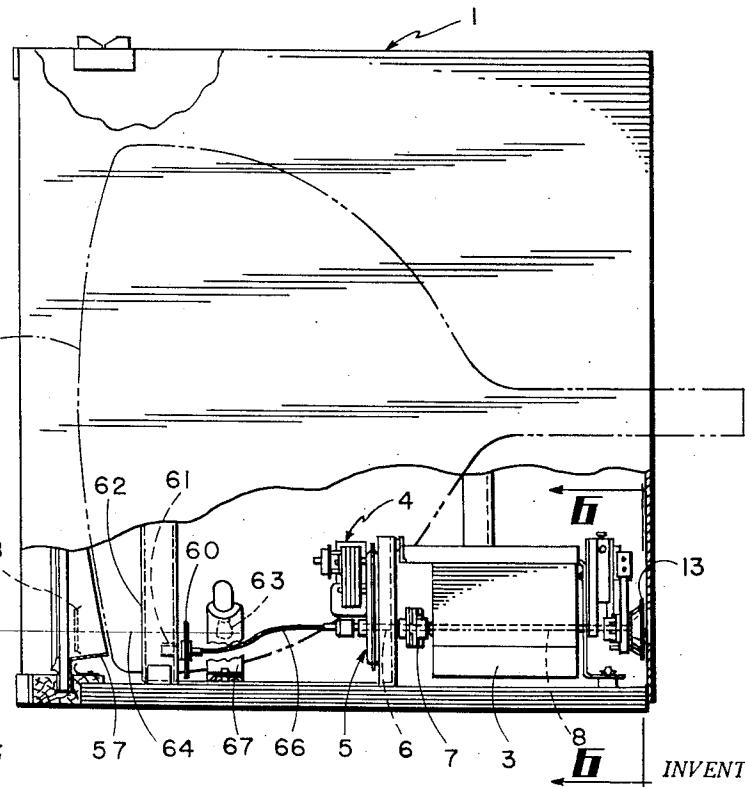
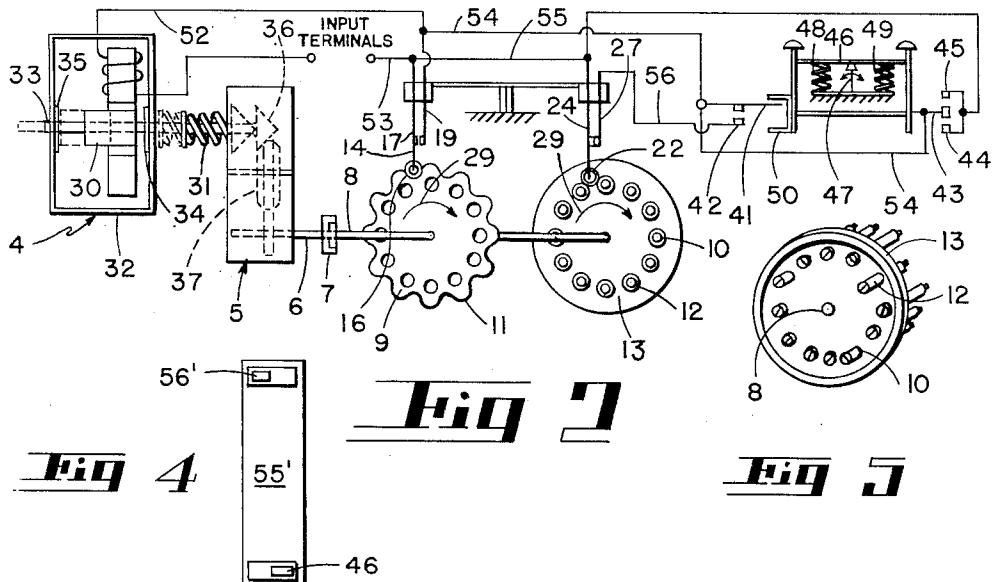
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2,812,486

SERVO SYSTEM ADAPTED FOR TELEVISION TUNING

Filed Sept. 17, 1956

2 Sheets-Sheet 1



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SERVO SYSTEM ADAPTED FOR TELEVISION TUNING

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2 Sheets-Sheet 2

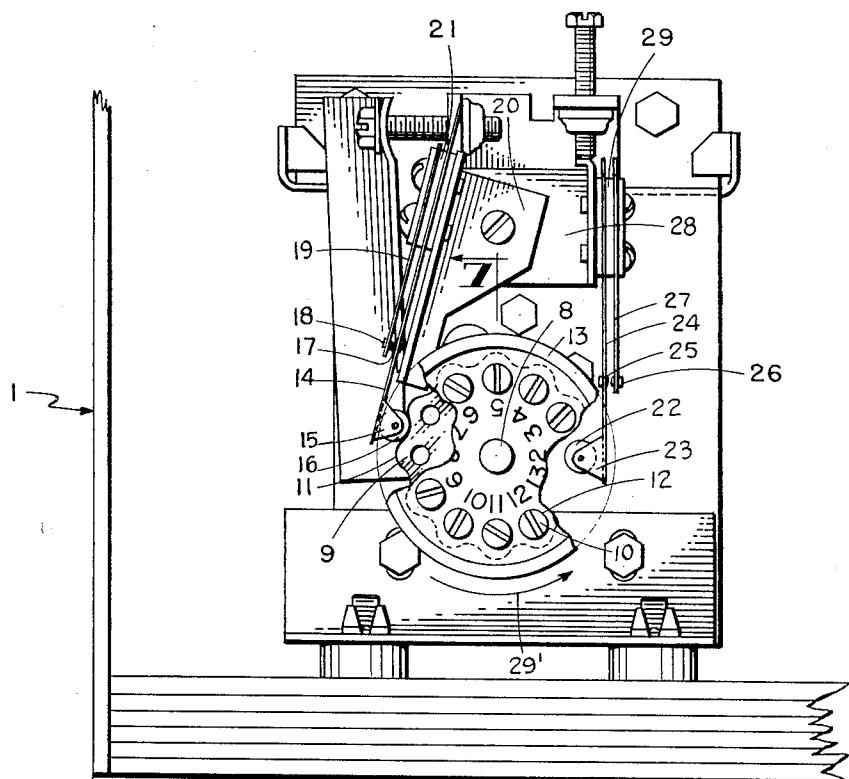


Fig 6

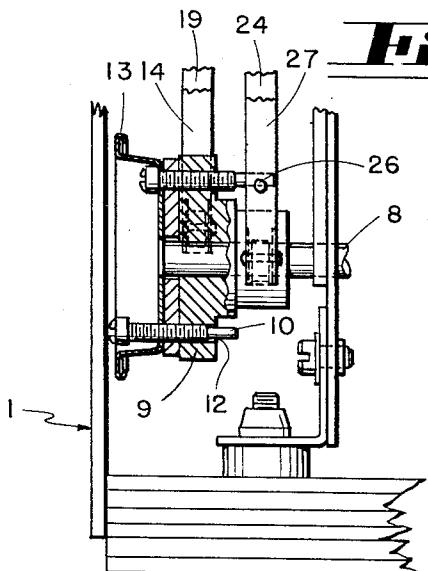


Fig 7

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SERVO SYSTEM ADAPTED FOR TELEVISION TUNING

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Application September 17, 1956, Serial No. 610,162

7 Claims. (Cl. 318—467)

The present invention relates to television receivers and particularly to a novel device for controlling a step-type television receiver tuner rapidly and conveniently and with a minimum of effort on the part of the operator.

An object of the invention is to provide a control device having such operation that the tuner of a television receiving set may be driven step by step to each one of its channel positions, for example, the twelve V. H. F. positions for the twelve standard V. H. F. channels. Alternately, the device may be operated automatically to drive the tuner only to the positions corresponding to the local stations in any area. The number of these local station positions is generally smaller; for example, in Cincinnati there are three V. H. F. stations, numbered 5, 9 and 12.

A further object of the invention is to provide, in combination, a motor-driven tuner, a manual mode-of-operation selector switch, a detent switch, a pair of cam-actuated switches and instantaneous contacts, all so arranged that the motor may be actuated to drive the tuner step by step or that the motor may be energized to drive the tuner to its positions for the few local stations only.

For a better understanding of the invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following description of the accompanying drawings.

In the drawings,

Fig. 1 is a side elevational view, partly in section, showing a television receiver, otherwise of conventional character, in which there is installed a control device in accordance with the invention;

Fig. 2 is a schematic diagram, partly in block form, partly in symbolic form, with cam and selector switch members shown in exploded view for purposes of facilitating the explanation of the operation of the invention;

Fig. 3 is a fragmentary front view showing the window on which there appears a number indicative of the channel to which the tuner is tuned;

Fig. 4 is a top view of the manual mode-of-operation selector embodied in the invention;

Fig. 5 is a perspective view of a spindle cam carrier and the spindle cams secured thereto;

Fig. 6 is a sectional view taken on line 6—6 of Fig. 1, looking in the direction of the arrows, with certain parts broken away to facilitate description of the construction of the cams embodied in the invention; and

Fig. 7 is a sectional view taken on section line 7—7 of Fig. 6 and looking in the direction of the arrows.

The invention is intended to be applied to or exploited in combination with a step tuner or one having a rotary turret. Tuners of this general character are described in many publications, inclusive of the following: Television Engineering, pages 630, 633, Fink, McGraw-Hill Book Co., New York, 1952; Television Fundamentals, pages 104, 105, Fowler & Lippert, McGraw-Hill Book Co., New York, 1953.

A typical turret type of tuner with which my novel control device is frequently used is the Standard Coil tuner, as described in Television Simplified, pages 87—90,

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Kiver, D. Van Nostrand Co., New York, 1954. Tuners of this general character embody rotary selector switches having a multiplicity of strongly detented positions. Substantial manual effort is normally required to turn the turret from one station to the next. The invention provides a means by which the tuner is electrically driven, with speed and precision and without substantial effort on the part of the operator.

In accordance with the invention, there is provided a novel control device for a step-type television receiver tuner. The device includes a motor 4 and a clutching arrangement 5 which mechanically couples the tuner drive shaft 8 to the motor. The motor is energized from a conventional source of power (not shown) connected to the input terminals shown. In accordance with the invention, tuning is accomplished by a three-position mode-of-operation selector switch 46, etc., normally in the static position shown. The selector has two operating positions into which it may be manually manipulated by the operator in order instantaneously to connect the motor to the source to energize the motor. That is, when the selector is in either its clockwise position for step-by-step operation (closing contacts 43, 44) or in its counter-clockwise position for automatic operation (closing contacts 43, 45), the selector instantaneously connects motor and source through a first energizing circuit to initiate the driving of the tuner. The inventive combination also includes a first cam-switch means for continuing to energize the motor as it drives the shaft from one tuner channel position to the next adjacent position and for stopping the motor after the tuner has turned through one position. This means comprises a cam 9, mounted on shaft 8, and a first switch (inclusive of elements 14 and 19) controlled by the cam 9 (by reason of the operation of follower 16). The switch elements 14 and 19 are included in a second circuit, parallel to the first energizing circuit, between motor and source for energizing the motor as it drives the shaft from one tuner channel position to the next adjacent position. That is, the instantaneous closing of contact 43 on either of contacts 44 or 45 having caused clockwise rotation of cam 9, the first switch closes, assuring continuation of rotation until the next channel position of the tuner is reached. Cam 9 is so proportioned, by reason of its troughs, as to open the first switch at the conclusion of the desired rotation. The first cam switch means, therefore, controls step-by-step operation.

In providing for automatic operation—i. e., the selection of the few local stations only—the invention further includes second cam-switch means for continuing the energizing of the motor as the turret turns through several channels, as from one local station position to another. This means comprises a plurality of spindles 10 mounted on a cam carrier 13, co-axial with cam 9. This means also comprises a second switch (including the elements 24 and 27) which is controlled by the cams 10 in such a way that the motor is continuously energized as the tuner turns from one local station position to another. The second switch is placed in circuit with the motor and source of power by the operation of a third or detent switch (including elements 41 and 42). The detent switch is positioned by the three-positioned mode-of-operation selector in such a way that when the selector is placed in its automatic or counter-clockwise position, the detent switch is closed. When the detent switch is closed, the second switch can be closed to energize the motor for automatic operation. On the other hand, when the selector is in its step-by-step or clockwise position, then the detent switch is open. The detent switch and second switch are in a third parallel energizing circuit between motor and source.

In Fig. 1, numeral 1 designates generally the television

set having the usual picture tube 2. The receiver is provided with a step-type tuner 3, driven by an electric motor 4 through a gear reduction 5. Initiation of the operation of the motor 4 is effected by closing of the contacts 43, 44 or 43, 45 of the selector 46, etc., which closes the first parallel energizing circuit, while continued operation and stopping of the motor are effected by cam-switch mechanisms (Figs. 6 and 7), which individually make and break second and third parallel energizing circuits. These mechanisms are so arranged that step-by-step or automatic operation is selected. In step-by-step operation, the motor stops at a channel position of the tuner by reason of the breaking of contacts 17, 18 of the first switch and the opening of the second parallel energizing circuit. In automatic operation, the motor stops at a local station position of the tuner by reason of the breaking of contacts 25, 26 of the second switch.

The output shaft 6 of the gear reduction 5 is coupled to a clutch or coupling 7 (see Fig. 1), which, in turn, is coupled to the tuner shaft 8. The tuner shaft 8 extends rearwardly of the set and has mounted at the rear end thereof the mechanism of cam switches.

The step-by-step or first cam-switch mechanism includes a scalloped cam 9, mounted on shaft 8. The automatic or second cam-switch mechanism includes a cam-carrier 13, mounted on shaft 8, and a plurality of spindles or cams 10. The angular position of each spindle 10 coincides with a tuner station position. As shown more particularly in Figs. 5 and 6, the spindles 10 may be in the form of short studs which are threaded through openings 12 in the cam 9 and cam-carrier 13. Being threaded, spindles 10 can individually be screwed inwardly into position to engage the follower 22 on the switch controlled thereby (the second switch) and to keep the switch closed, or they may be retracted outwardly to a position where they do not engage that follower and accordingly permit the switch to open.

Associated with the scalloped cam 9 of the first cam-switch mechanism is a switch member 14 of spring or leaf-like construction having at its free end a clip 15 for supporting a roller 16 which follows the undulations of the cam 9. The member 14 is provided with a contact 17 disposed to make or break contact with a contact 18 on a switch member 19. The switch members 14 and 19 are anchored in a bracket 20 carried by the frame of the tuner as shown. The anchored ends of the switch members are insulated from each other as at 21. The secured ends of these switch members 14 and 19 form the terminals of the first switch. As the cam 9 rotates with its shaft 8, the contact member 17 engages contact member 18 when the cam follower roller 16 passes over the crest of a lobe 11; these contacts separate or break the second energizing circuit when the follower is in a trough between the crests of a pair of lobes—i. e., when the tuner is in any one of its channel positions.

The spindles 10 of the second cam-switch mechanism project axially inwardly through the cam 9 and carrier 13 and are disposed to engage a cam follower roller 22 carried by a bracket 23 at the free end of a spring switch member 24. Switch member 24 is provided with a contact 25 disposed to engage a contact 26 on a switch member 27. The switch members 24 and 27 are secured at their fixed ends in a bracket 28 of the frame associated with the tuner and are insulated from each other by insulation 29. The fixed ends of the switch blade members 24 and 27 form the terminals whereby the contacts 25 and 26 may be caused to perform the circuit-controlling function for automatic operation. Contacts 25 and 26 separate or break the third energizing circuit when the tuner is in one of its selected local-station positions, characterized by retraction of the corresponding spindle 10.

The switch members 24 and 27 of the second cam-switch mechanism control local station selection with

automatic tuning. If, for example, the television set is used in an area where the station channels are identified by channel numbers 3, 5 and 10, then the spindles 10 corresponding to those numbers are screwed to the retracted position with respect to cam 9 and cam carrier 13 so as to be out of the path of engagement with the cam follower roller 22. Therefore, when the cam carrier 13 rotates to an angular position where there is no spindle to engage the cam follower 22, the switch contact members 25 and 26 of the second cam-switch mechanism move to open position and interrupt the power to the motor by opening the third parallel energizing circuit.

In Fig. 2 the circuitry for the motor and the cam switches is illustrated schematically. Motor 4 may be a two-pole shaded pole motor and provided with a solenoid armature 30. The armature as shown is normally urged out of its central magnetic position with reference to the field poles of the motor by means of a spring 31 disposed between the housing of the gear reduction 5 and the frame or housing 32 of the motor. The shaft 33 of the armature 30 is journaled in bearings 34 and 35, as shown. The end of the motor shaft 33 that extends into the housing of the gear reduction is provided with a cone gear or pinion 36. When the motor is de-energized, that pinion is disengaged by spring 31 from a driven gear 37, thereby preventing over-running of the tuner that could result if the pinion were not disengaged. The driven gear 37 is in the chain of gears that ultimately lead to the driven or output shaft 6.

When the motor is energized, the field of the motor pulls the armature to the right, as viewed in Fig. 2, causing the gear 36 to mesh with the mating gear 37, whereupon the tuner shaft 8 is clutched to the motor and driven.

In Fig. 2 the cam 9 and the spindle carrier 13 are shown separated, that is, in an exploded view. When cam 9 is in the particular angular position shown, cam follower roller 16 of switch member 14 lies in a trough between a pair of lobes of cam 9. Therefore, the switch contact members 17 and 18 of the first switch are disengaged. When the cam follower roller 22 is in engagement with one of the spindles, the contact members 25 and 26 of the second switch are in engagement.

The mode-of-operation selector is provided with contacts 43 and 44-45 for energizing the motor through a first energizing path parallel with the second and third paths of cam switches 14, 19 and 24, 27, respectively, whereby motor 4 may be caused to initiate operation (when such contacts are instantaneously closed). The selector also includes a detent switch (having contacts 41 and 42) in series with the second cam switch 24, 27, which cam switch operates to stop the motor and tuner at one of the local station positions. The detent switch, a part of the selector, performs the function of setting up the second switch circuit when automatic operation is desired and cutting out that circuit when step-by-step operation is called for. In local station or automatic operation, the pairs of contacts 43 and 45 and 41, 42 are momentarily closed, the motor starts and contacts 41, 42 remain closed so that the motor does not stop until the second cam switch 24, 27 opens. Switch 24, 27 opens when the angular position of cam carrier 13 and shaft 8 and the tuner are such that roller 22 registers with a retracted spindle, i. e., when the tuner is on a local station. To re-energize the motor and turn the tuner turret beyond that stopping point, the contacts 43, 45 of the selector are momentarily closed, thereby effecting re-energization of the motor and a resumption of its operation until the next local station is reached, at which time the motor will again stop.

The arrangements for automatic control in the selector comprise the detent switch having contact members 41 and 42. The member 41 and contact 43 are actuated by 75 a rocker member 46 mounted on a pivot 47 and normally

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urged to a neutral position by springs 48 and 49 that engage member 46 on opposite sides of the pivot 47. The rocker member 46 is provided with spaced lugs 50 for operating detent switch 41 either to open or closed position with reference to its stationary contact member 42. When switch member 41 has been actuated to either of these positions by lugs 50 and the rocker member 46 has been released, the rocker returns to neutral position, but switch member 41 remains in the position to which it had been actuated until reactivated by lugs 50.

When the rocker member 46 is actuated to engage switch member 43 with contact member 44, detent switch member 41 will be opened if in the closed position, and the motor 4 is connected to the power source represented by the input terminals. The motor will remain connected to the power source by the operator only so long as the switch member 43 is in engagement with contact 44. Momentary contact between member 43 and contact member 44 is sufficient to insure operation of the motor 4 because a second parallel circuit for the motor is maintained through the closed contact members of switch members 14 and 19 even after contacts 43 and 44 separate. That is, as soon as the motor starts to operate, one of the lobes 11 will close the contacts of step-by-step control switch members 14 and 19 and maintain a closed motor circuit until the cam follower roller 16 drops into the valley between the next pair of lobes.

When the rocker member 46 is turned counter-clockwise on its pivot, the detent switch is closed on its stationary contact member 42. Further, the switch member 43 momentarily engages contact member 45, thereby momentarily energizing motor 4 and causing it to operate through the first parallel energizing circuit established by the closing of contact 41 on its contact 42. Upon release of the rocker 46, contacts 43, 45 open but the motor continues running, by reason of the closing of the third parallel energizing circuit, until the spindle cam or automatic switch 24, 27 opens at a dead spot where there is no spindle to engage the cam follower 22. That stopping point or angular position would indicate or correspond with one of the tuner positions for local stations available in a particular area where the receiver is being operated. If that station is not the one desired, the next local station may be selected by merely momentarily closing the contact member 43 on contact member 45 and at the same time reclosing the detent switch contact 41 on contact member 42.

The selector is mounted in an escutcheon plate or bar 55' located at the front of the top of the cabinet of the receiver 1, as shown in Figs. 1 and 4. The escutcheon plate or bar 55' is provided at one end with an on-and-off switch 56' whereby the power input to the television set and to the motor input terminals may be controlled. At the opposite end of the plate or bar 55' the selector is mounted. By merely tilting the rocker 46 of the selector either counter-clockwise or clockwise, as viewed in Fig. 1, the tuner mechanism may be operated to select automatically the local stations, or it may be operated step-by-step, as described supra.

The receiver shown also is provided with an illuminated channel indicator that is operated by the drive mechanism for the tuner 3. As shown in Fig. 1, the television tube 2 is mounted at the front in a frame or border 57 provided with a tubular boss 58 in the outer end of which is a translucent screen 59 as disclosed in my co-pending application for patent, Serial No. 568,473, filed February 29, 1956, assigned to Avco Manufacturing Corporation and entitled "Channel Indicators for Television Receivers." The screen 59 indicates by means of an illuminated digit the particular station to which the set has been tuned, and that illuminated digit may be visible by a viewer from any point from which the picture on the screen of the tube may be seen. The channel indication which appears on the screen 59 derives from a rotatable

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disk 60 having near the perimeter thereof apertures which are formed in the shape of the particular digits. The digits may run from 1 to 12 or any other desired number. The disk 60 is mounted on a shaft 61 journaled in a frame 62. Between the tuner and the disk is a light source 63 which is focused to project light rays through the particular aperture that comes into register with its beam 64. The light beam shining through a digit causes the outline or form of the digit to appear on the translucent screen. The shaft 61 of disk 60 is driven by the output shaft of the gear reduction 5 through a flexible cable 66.

The light source 63 may be mounted on any suitable support, preferably as shown in my co-pending application above mentioned, wherein means is provided for adjusting the position of the light bulb so that it properly focuses with the digits on the circular disk and the screen.

Recapitulating, the television receiver is provided with a mode-of-operation selector 46, etc. (Fig. 2). This selector has three positions: An inactive position to which it is normally biased by springs 48 and 49; and two operating positions. The clockwise operating position is for step-by-step operation. That is, the operator simply depresses the teeter-totter selector in a clockwise direction. When this is done instantaneously, the tuner simply moves one step to the next channel and stops. On the other hand, if the operator continues to hold contact 43 against contact 44 by keeping his hand on the switch, then the device continues to move step by step until the hand is removed, breaking contacts 43, 44. During this type of operation a lug 50 separates the contacts 41, 42 and prevents automatic operation. It will be seen that the operation of contacts 43, 44 and the closing of the first energizing circuit start the motor 4, but the motor 4 continues in operation for one step by reason of the operation of cam 9, which closes a second parallel motor-energizing circuit through switch contacts 14, 19. When the tuner has reached the next step or station or position, the switch 14 and 19 opens.

Now let us further briefly consider automatic operation. When the teeter-totter selector 46, etc., is instantaneously manually depressed into the counter-clockwise position, the motor action is initially energized by the closing of contacts 43, 45, which function in the same manner as the contacts 43, 44. Now a third circuit, made up of the series elements 41, 42 and 24, 27, enters into the picture. These elements, functioning together as a closed circuit during automatic operation, furnish a third parallel energizing circuit to the motor between local station positions. As has been shown, this circuit is de-energized by the opening of switch 24, 27 when a local channel position is indicated by retraction of the corresponding spindle 10.

To repeat, for either type of operation the motor is first instantaneously started by appropriate motion of contact 43. In either type of operation the motor is caused to move the tuner step by step by the action of cam 9 and first switch 14, 19. On automatic operation the motor is caused to run for several successive steps by reason of the operation of carrier 13, spindles 10, the second switch 24, 27, and the detent switch 41, 42, the latter always being closed during automatic operation.

Having thus described the invention, it will be apparent to those of ordinary skill in the art to which the invention pertains that various modifications and changes may be made in the illustrated embodiment without departing from either the spirit or the scope of the invention.

Therefore, what is claimed as new and desired to be secured by Letters Patent is:

1. A control device for a step-type television receiver tuner, comprising a motor and tuner shaft for driving the tuner, a source of power, a three-position mode-of-operation selector having contacts in circuit with said motor and normally having a neutral position, but operable in either of two other positions instantaneously to close said contacts and connect the motor to the source to energize the motor, and means responsive to angular shaft displacement for continuing to energize the motor as the

shaft turns between successive predetermined channel positions of the tuner, the last-mentioned means comprising a cam mounted on the tuner shaft and a switch controlled by the cam and inclusive of contact elements between motor and source, the last-named contact elements being made to energize the motor, the cam being so proportioned as to open the switch and stop the shaft and tuner by breaking such contact elements at any tuner channel position.

2. A control device for a television receiver tuner, comprising a motor and shaft for driving the tuner, a source of power, a three-position mode-of-operation selector having contacts in circuit with said motor and normally having a neutral position, but operable in another position instantaneously to close said contacts and connect the motor to the source through a first circuit to energize the motor, and cam-switch means including a rotatably mounted cam controlled by the shaft for continuing to energize the motor through a second parallel circuit as the shaft turns from one channel position of the tuner to the next adjacent position.

3. A control device for a step-type television receiver tuner, comprising a motor and shaft for driving the tuner, a source of power and a three-position mode-of-operation selector having contacts in series with said motor and normally having a neutral position, but operable in either of two other positions instantaneously to connect the motor to the source to energize the motor, means responsive to angular shaft displacement for continuing to energize the motor as the shaft turns from one channel position of the tuner to the next adjacent position, the last-mentioned means comprising a cam mounted on the shaft and a switch controlled by the cam and inclusive of contact elements made for energizing the motor to drive the shaft from one tuner channel position to the next adjacent position, the cam being so proportioned as to open the switch and stop the shaft by breaking such contact elements at any tuner channel position, means responsive to angular shaft displacement for continuously energizing the motor as the shaft turns between successive local station positions of the tuner, the last-mentioned means comprising other cams secured to the shaft and a switch controlled by such other cams and inclusive of contact elements between motor and source, which last-named contact elements are made for energizing the motor between local station positions of the tuner, said other cams being so constructed and arranged as to open the last-mentioned switch in any local station tuner position, and an on-off detent switch in series with the last-mentioned switch and controlled by the selector to be turned "on" when the selector is in one operating position and "off" when the selector is in its other operating position.

4. A control device for a television receiver tuner, comprising a motor and shaft for driving the tuner, a source of power and a three-position mode-of-operation selector normally having a neutral position, but operable in either of two other positions instantaneously to connect the motor to the source to energize the motor through a first circuit, cam-switch means including a rotatably mounted cam controlled by the shaft for continuing to energize the motor through a second circuit as the shaft turns from one channel position of the tuner to the next adjacent channel position, other cam-switch means including another rotatably mounted cam controlled by the shaft for continuing to energize the motor through a

third circuit as the shaft turns between successive local station positions of the tuner, and switch means controlled by the selector for activating one of the cam-switch means when the selector is in one operating position and both cam-switch means when it is in the other operating position.

5. A control device for a television receiver tuner, comprising means for driving the tuner, a source of power and a three-position mode-of-operation selector normally having a neutral position, but operable in either of two other positions instantaneously to connect the driving means to the source to energize the driving means, means including a rotatably mounted cam and responsive to initial movement of the driving means for continuing the drive from one channel position of the tuner to the next adjacent channel position, means including another rotatably mounted cam and responsive to initial movement of the driving means for continuing the drive between successive local station positions of the tuner, and means included in the selector for selecting either of the last-mentioned two means.

6. A switch mechanism for so controlling the operation of a motor disposed to drive a driven element as to provide controlled step-by-step and selective interruptions in the operation of the motor, comprising a motor, parallel circuit-connected switches in circuit with the motor, separate rotatably mounted cam means for operating each of said switches, one of said cams having uniformly spaced lobes for step-by-step operation, and the other of said cams being provided with preselectable skip means, whereby the number and location of the interruptions may be predetermined at will, and a mode-of-operation selector including momentary circuit-closing means in circuit with the motor and in shunt relation to the switches for initiating step-by-step or continuous energization of the motor circuit at will.

7. A motor-driven tuner for a television receiver, comprising a tuner having a rotating element, a gear reduction unit having an input shaft and pinion and an output shaft connected to the rotary element of the tuner, a motor having a solenoid armature and a shaft coupled to the input shaft of the gear reduction, whereby the pinion is engaged with or disengaged from its driven gear upon energization or de-energization of the motor, a manually operable detent switch and momentary circuit-making means, a pair of rotatably mounted cams driven by the tuner and secured to its rotating element, one of said cams having uniformly spaced lobes, the other cam having uniformly spaced cam members which may be preselectively placed in or out of operative condition, a switch for each cam, the switch associated with the lobe cam being in parallel with the momentary circuit-making means and disposed to maintain the motor circuit for intervals equal to the spacings between adjacent lobes, and the other cam switch being in series with the detent switch and disposed to maintain the motor circuit until its cam has rotated to a point where a cam member is out of operative condition with respect thereto.

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