Nov. 20, 1962 A. LA BOV 3,065,398

POSITIONING MECHANISM

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FIG. 1.

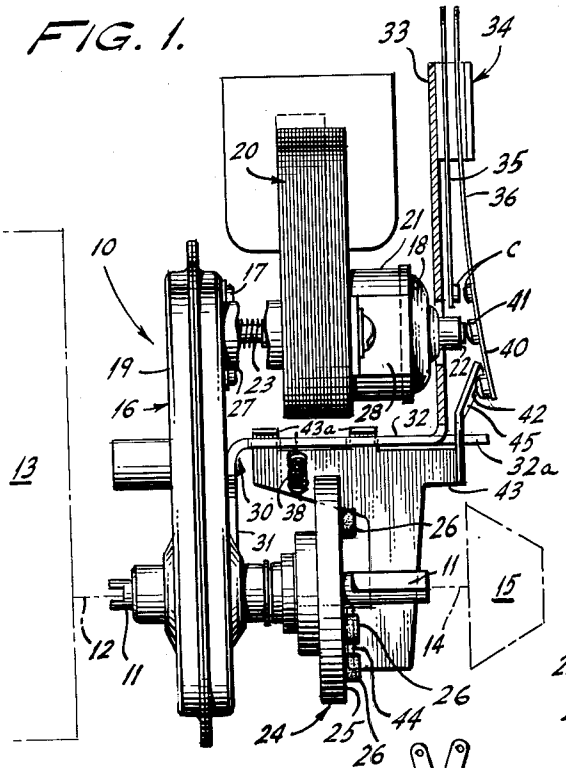


FIG. 2.

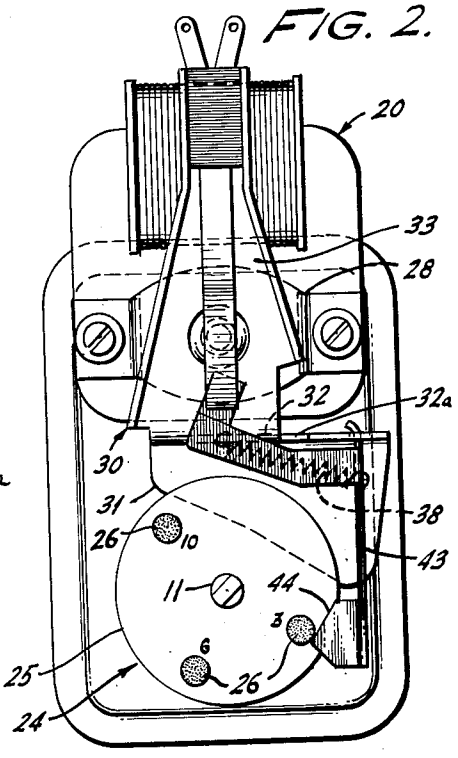


FIG. 3.

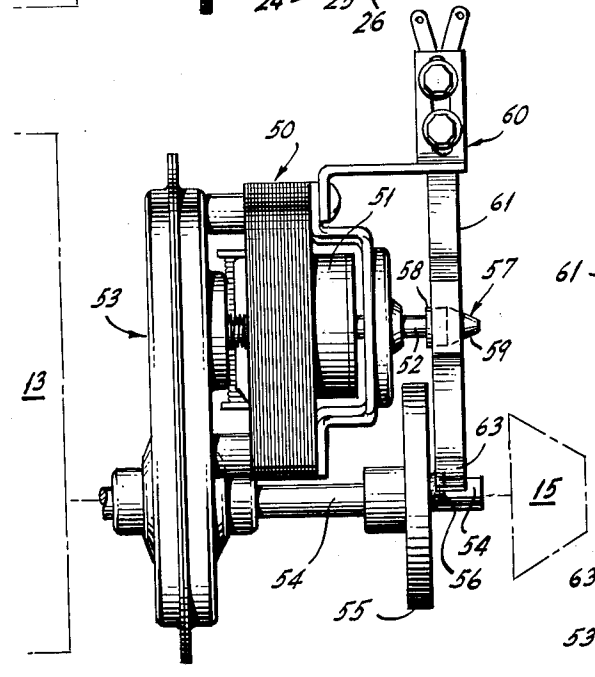
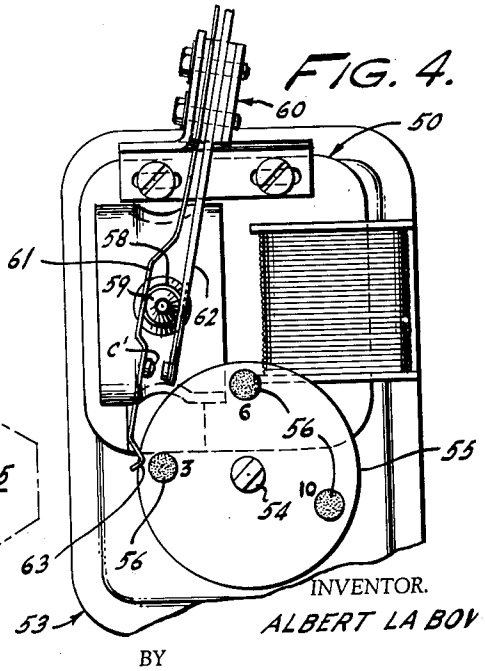


FIG. 4.



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POSITIONING MECHANISM

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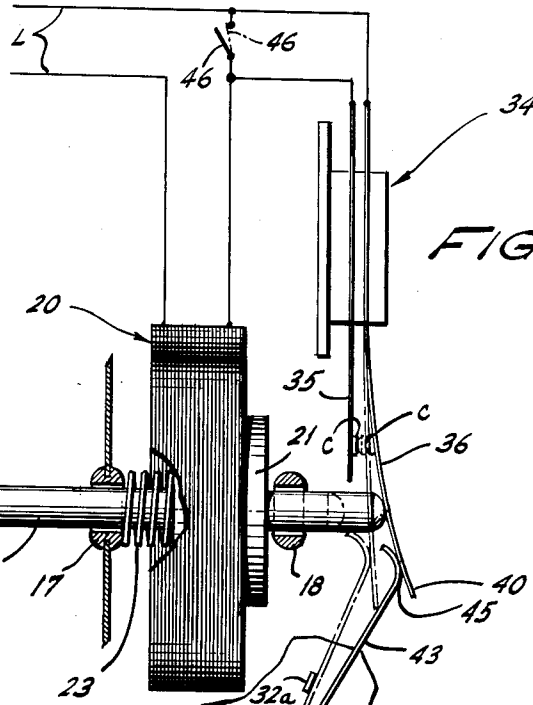


FIG. 7.

FIG. 5.

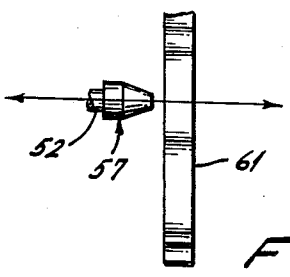
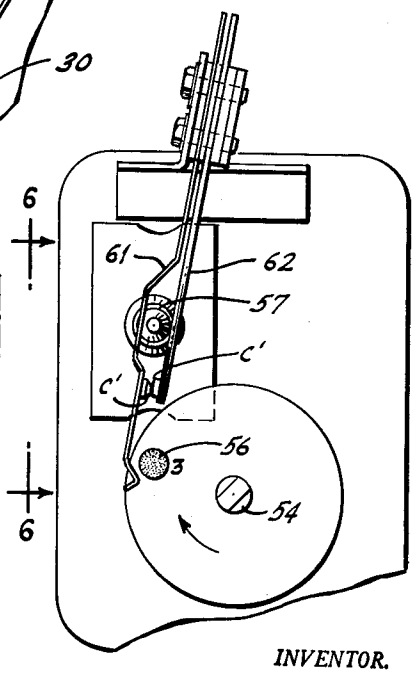


FIG. 6.



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3,065,398

POSITIONING MECHANISM

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Filed Apr. 14, 1958, Ser. No. 728,471
7 Claims. (Cl. 318—467)

This invention relates to positioning mechanisms, and more particularly to mechanisms for positioning rotatable shafts.

The present invention has to do, specifically, with improvements in apparatus of the type disclosed and claimed in the co-pending application of Hermann E. F. C. Lingenbrink and Albert La Bov, Serial No. 643,175, filed February 28, 1957, now U.S. Patent 2,965,829, issued December 20, 1960, and assigned to the assignee of the present invention.

The present invention has as its primary objective the provision of novel electromechanical means for operating rotatable apparatus through predetermined sequential angular increments.

Another object of the invention is the provision of a positioning mechanism which is automatically responsive to momentary closing of a control switch to drive a rotary device coupled therewith, moving it from one position to another, and then to shut the mechanism off.

A further object of the invention is to provide a positioning mechanism which will self cycle through a number of positions automatically.

It is also an object of the invention to provide positioning apparatus, for a rotary device, affording, selectively, either electrical or manual operation thereof.

A specific object of the invention is the provision of a self cycling mechanism adapted to remote control, and in which a single control impulse from a remote switch will cause the mechanism to cycle until the desired predetermined position is reached.

It is a particular object of the invention to provide apparatus suited for remote actuation of channel selector means in television receivers.

A further and still more specific object of the invention is to provide mechanism of the above-stated type which is simple in construction and operation, easy to adjust, yet is characterized by rugged construction.

It is a characteristic feature of this invention to utilize movement of the rotor of a drive motor to modify a switching function in such a manner that manual rotation of the driven shaft is afforded independently of the drive mechanism.

In accordance with a preferred embodiment of the present invention, and first briefly described, the apparatus includes a motorized self cycling drive mechanism for positioning a rotatable shaft, said mechanism being moved sequentially through predetermined angular increments. Each angular increment corresponds to a different television channel, as provided by a rotatable channel selector coupled with the rotatable shaft. The mechanism includes indexing means driven with the shaft and so constructed and arranged as releasably to engage switch means to deenergize the motor when the shaft is rotated to the next preselected indexed position.

It is a feature of the invention that the motor includes means operable releasably to engage the switch means, to maintain the motor energizing circuit open, in response to deenergization of the motor. Thus manual operation of the rotatable shaft is afforded without bringing into play the self cycling mechanism, in response to release of the switch means by the indexing means, inasmuch as the switch is forcibly held open by the rotor of the deenergized motor.

The manner in which the foregoing, as well as other

objectives and advantages of the invention may best be achieved will be understood from a consideration of the following detailed description taken together with the accompanying drawings, in which:

FIGURE 1 is a side elevational showing, with parts broken away, of one form of apparatus embodying the invention;

FIGURE 2 is a front elevational showing of the apparatus seen in FIGURE 1;

FIGURE 3 is a side view, in elevation, of a modified embodiment of the invention;

FIGURE 4 is a front view, in elevation, of the apparatus seen in FIGURE 3, but with parts broken away;

FIGURE 5 is a somewhat diagrammatic view similar to FIGURE 4, and showing an operational feature of the invention;

FIGURE 6 is a fragmentary view looking substantially in the direction 6—6 as applied to FIGURE 5; and

FIGURE 7 is a somewhat diagrammatic showing of operational features of the embodiment of the invention shown in FIGURES 1 and 2, and including an electrical wiring diagram.

Now making more particular reference to the drawing, and first to FIGURE 1, a shaft positioning mechanism 10 is coupled with a rotatable shaft 11 to be driven through predetermined angular increments, said shaft including an extension 12 adapted to drive, for example, a television channel selector or tuner 13. Shaft 11 also includes an extension 14 to which a suitable knob 15 is affixed, whereby manual rotation of the shaft 11 and tuner 13 is afforded, as will be hereinafter more fully described.

The positioning mechanism 10 comprises reduction gear means 16 which may be of known type, including a housing 19, enclosing a drive coupling between shaft 11 and an electric driving motor 20 mounted on the housing by suitable tubular bracket means 27, a section of which has been cut way to illustrate the spring 23. The motor 20 is of the offset-rotor type, including a rotor 21 affixed to the shaft 22. Shaft 22 is suitably journalled to the gear housing 19 and to bracket means 28 affixed to the motor 20, as seen respectively at 17 and 18. The rotor 21 and shaft 22 are axially movable, as a unit, in response to energization and deenergization of the motor 20. A compression spring 23 reacts between the rotor 21 and journal 17 resiliently to urge the rotor to the extended, or deenergized, position shown. The end of the shaft 22 journalled at 17 includes a pinion 29 (see FIGURE 7) releasably engageable with drive gearing 37 disposed within housing 16, in response to the aforementioned axial movement of the rotor 21.

Referring to FIGURE 2, it will be seen that indexing means 24 for the shaft 11 comprises a wheel 25 provided with indexing pins 26 disposed at predetermined angular increments corresponding, for example, to channels 3, 6, and 10 of the illustrated television tuner.

A generally S-shaped bracket 30 (FIGURE 1) includes a portion 31 affixed to the gear housing 16, a web portion 32 extending away from the housing, and a portion 33 extending upwardly and substantially parallel to portion 31. A holding switch 34 is mounted upon bracket portion 33, said switch including contacts C, one of the contacts being carried by a substantially rigid contact arm 35 and the other by a somewhat resilient arm 36, the latter being movable with respect to arm 35 to open and close the said contacts. As seen in FIGURE 7, switch 34 is disposed in series circuit with the electrical source, or line, L and the motor. Also provided is a momentary switch 46, of known design, connected in parallel with switch 34. Switch 46 is actuatable to energize the motor, whereas switch 34 is actuatable to maintain such energiza-

tion for a predetermined period of time, as will be more fully understood from what follows.

As best seen in FIGURE 1, arm 36 includes an extension 40 provided with a pair of electrically non-conductive bearing members 41 and 42. When the motor 20 is deenergized (the position shown) the shaft 22 is urged by spring 23 into engagement with bearing member 41 to hold the resilient arm 36 in such position as to maintain the contacts C open.

A lever 43 is pivotally mounted, at 43*a*, to horizontal portion 32 of the bracket 30. The lever 43 includes a cam portion 44 operably engageable by indexing pins 26 to pivot the lever to move cam portion 45 into engagement with bearing member 42, thereby flexing arm 36 to open the switch contacts and deenergize the motor. As best seen in FIGURE 1 the cam portion 45 comprises a portion of the lever disposed with slight angularity to the plane of pivotal movement of the lever, and wedging against the bearing member 42 in response to such pivotal movement. A tension spring 38 extends between bracket portion 32 and lever 43 resiliently to urge cam 44 toward indexing wheel 25 and against pins 26. Movement of the cam in this direction is limited by stop means 32*a* releasably engageable with lever 43.

Additional advantages, as well as a better understanding of structural features of the embodiment of FIGURES 1 and 2, will be appreciated from further consideration of the somewhat diagrammatic showing of FIGURE 7, wherein the shape of lever 43 has been simplified slightly, and members 41 and 42 have been omitted, for the sake of clarity.

In the operation of the above described embodiment, and referring particularly to the broken line showing of FIGURE 7, the motor 20 is energized by closing, momentarily, switch 46. Energization of the motor causes the rotor 21 and shaft 22 to move axially, to the left, thereby moving pinion 29 into driving engagement with the upper gearing 37. Axial movement of the shaft 22 also causes the latter to disengage the resilient switch arm 36, thus permitting the switch contacts C to close and maintain energization of the motor. Rotation of the motor drives shaft 11, through gearing 37. Indexing wheel 25 is driven with shaft 11, and pin 26, for example the pin opposite channel 3, moves to 26*a*. In so moving, pin 26 disengages portion 44 of lever 43 to permit the latter to pivot, as urged by tension spring 38. In response to this pivotal movement, portion 45 of the lever 43 moves in a direction accommodating flexing movement of the resilient switch arm 36 to its closed position, thereby to maintain energization of the motor.

As the motor drives the shaft 11, through a predetermined angular increment, for example to its next indexed position corresponding to channel 6, the corresponding index pin 26 will engage portion 44 of the lever (see also FIGURES 1 and 2), and pivot the latter thereby causing cam portion 45 thereof to flex resilient switch arm 36 to open the switch contacts and deenergize the motor. Such deenergization results in axial movement of the shaft 22 by spring 23 against the switch arm 36, to maintain the open-switch position shown. The tuning operation is now stopped and the apparatus is tuned to channel 6. Other channels are, of course, tuned-in in the same manner, and as a result of only momentary contact of the switch 46. The initial opening of the switch contacts need only be in the order of a thousandth of an inch to effect collapse of the motor field and permit the translatable rotor to be moved into its switch holding position. This small switch opening readily accommodates a fine degree of indexing.

An important advantage of the present invention lies in the fact that the switch 34 is held open by the rotor of the deenergized motor, thus permitting manual operation of the shaft 11, as afforded by knob 15, without again initiating the automatic positioning means in response to disengagement of the index pin 26 from cam 44 of the lever. In other words, and as best seen in FIGURE 7, although manual rotation of the shaft 11 by knob 15 will cause the indexing pin 26 of each channel to pivot the lever 43 as shown, no operation of the holding switch will result, due to its being held open by the rotor shaft 22.

A modification of the invention is seen in FIGURES 3, 4, 5, and 6, including the basic elements of a drive mechanism similar to that hereinbefore described, and including a motor 50, an axially movable rotor 51 and shaft 52, gear housing 53, driven shaft 54, indexing wheel 55, and electrically non-conductive pins 56. Driven with shaft 54 are knob 15 and tuner 13, said knob also providing means for manually rotating the shaft in the manner described.

The shaft 52 is provided with an electrically non-conductive wedge-like cam means 57 including a cylindrical portion 58 and a frustro-conical portion 59. Conical portion 59 is releasably engageable, in response to axial movement of shaft 52, with the resilient actuating arm 61 of switch 60. Arm 62 of the switch is substantially rigid, and each of the arms 61 and 62 are provided with contacts C'. As best seen in FIGURE 4, engagement of switch arm 61 by the cam 57, moves the arm to a position opening the switch contacts C' to maintain deenergization of the motor. Conversely, disengagement of the switch arm by the cam means 57 (see FIGURE 6) permits the resilient arm 61 to move into the closed-switch position, as seen in FIGURE 5. Switch arm 61 also includes a cam portion 63 releasably engageable with index pins 56 to actuate the switch either to deenergize or maintain energization of the motor.

Initiation of the positioning function of this latter embodiment is effected in the same manner as shown in FIGURE 7. Closing of a momentary switch energizes the motor whereupon its rotor 51 and shaft 52, along with cam means 57, moves to the left, as seen in FIGURE 6, thereby releasing resilient switch arm 61. Substantially simultaneously with the aforementioned release the motor drives the shaft 54 and indexing wheel 55, moving the pin 56 corresponding, for example, to channel 3 from the path of cam portion 63, thereby affording closure of the holding switch 60.

As best seen in FIGURE 4, manual rotation of the shaft 54 can be carried out independently of the motor drive means, particularly inasmuch as the switch 60 is held open through the positive restraint of the resilient actuating arm 61 by cam means 57.

Also, as to both embodiments of the invention, the positioning mechanism may be caused to operate past undesired indexed shaft positions by holding the momentary switch closed until the shaft has rotated past these positions. Release of the switch just prior to the desired shaft position will of course result in automatic selection of this position by the mechanism.

While no detent means has been illustrated for holding either of the shafts 11 or 54 in their respective indexed positions, it is to be understood that such means may be provided as an integral part of the driven tuner 13.

It is also to be understood that the momentary switch 46 may be positioned in any desired location. For example it may be disposed in a suitable location in the cabinet of a television receiver, or the like, or it may be placed in location apart from a receiver thereby to provide for remote tuning thereof.

Also, it will be appreciated that the present invention is susceptible to certain modifications, other than those illustrated, without departing from the scope of the appended claims. For example rigid switch arms 35 and 62 of each of the illustrated embodiments may be made resilient and suitable manually operable linkage means associated therewith to actuate the same to close the respective contacts, thereby initiating the stepping operation. Such initiating means may be provided either in lieu of or in addition to momentary switch 46.

I claim:

1. Apparatus for angularly positioning rotatable shaft means, comprising: motor means including a rotatable shaft for imparting incremental angular motion to said shaft means, said shaft being axially movable between a pair of positions in response to energization and deenergization of said motor means; a switch actuatable either to energize or deenergize said motor means; indexing means movable with said shaft means; and means coupled with said switch, to actuate the same, and being engageable by said indexing means, when the latter reaches a predetermined position, to deenergize the motor means to effect movement of its shaft to one of its said pair of positions, the shaft in the said one position engaging said switch to maintain the latter in its motor-deenergizing position.

2. Apparatus for angularly positioning rotatable shaft means, comprising: motor means including a rotatable shaft for imparting incremental angular motion to said shaft means, said shaft being axially movable between a pair of positions in response to energization and deenergization of said motor means; a switch actuatable either to energize or deenergize said motor means; indexing means movable with said shaft means; and lever means coupled with said switch to actuate the same, and being engageable by said indexing means, when the latter reaches a predetermined position, to deenergize the motor means to effect movement of its shaft to one of its said pair of positions, the shaft in the said one position engaging said switch to maintain the latter in its last mentioned actuated position.

3. Apparatus for angularly positioning rotatable shaft means, comprising: motor means including a rotatable shaft for imparting incremental angular motion to said shaft means, said shaft being axially movable between a pair of positions in response to energization and deenergization of said motor means; indexing means movable with said shaft means; and a switch including a lever arm actuatable to operate the former either to energize or deenergize said motor means, said lever arm being engageable by said indexing means, when the latter reaches a predetermined position, to deenergize the motor means to effect movement of its shaft to one of its said pair of positions, the shaft in said one position engaging said lever arm to maintain the switch in its last mentioned actuated position.

4. In combination with manually rotatable shaft means, electro-mechanical means selectively operable to rotate said shaft means to a predetermined position, comprising: motor means including a rotor disposed and adapted to rotate said shaft means, said rotor being axially movable between a pair of positions in response, respectively, to energization and deenergization of the motor means; indexing means rotatable with said shaft means and providing for predetermined angular displacement of said shaft means; circuit means including momentary switch means for energizing said motor means to rotate said shaft means; and a switch releasably coupled with said indexing means to open said circuit to deenergize said motor means, said switch being also releasably engageable by said rotor when it moves to one of said positions in response to such deenergization to maintain said circuit-open, thereby preventing inadvertent closing of said switch upon selective manual rotation of said shaft means.

5. In combination, rotatable shaft means, manually operable means for rotating said shaft means through predetermined angular increments, drive means selectively coupleable with said shaft means to rotate the latter including a motor having a rotatable member axially movable in response to deenergization and energization of the same, momentary switch means for energizing said motor means, indexing means for said shaft means and rotatable therewith, and a holding switch for maintaining said motor energized and releasably engageable by said indexing means when the shaft means has moved through a predetermined angular increment to deenergize the motor and effect axial movement of the rotatable member, said axially movable member being disposed and adapted to engage the actuated holding switch, in response to deenergization of the motor, to prevent its closing upon disengagement thereof from said indexing means upon manual rotation of the shaft means.

6. Apparatus for angularly positioning rotatable shaft means, comprising: drive means coupled to said shaft means to rotate the latter through angular increments; motor means including a rotatable shaft for imparting the incremental motion to said drive means, said shaft being axially movable betweeen a pair of positions in response to energization and deenergization of said motor means; switch means including a resilient arm actuatable either to energize or deenergize said motor means; indexing means movable with said shaft means; and cam means associated with said resilient arm and being engageable by said indexing means, when the latter reaches a predetermined position, to actuate the switch means to deenergize the motor means to effect movement of its shaft to one of its said pair of positions, the shaft in said one position engaging said resilient arm to maintain the switch means in its motor-deenergizing position.

7. Apparatus for angularly positioning rotatable shaft means, comprising: motor means including a rotatable shaft for imparting incremental angular motion to said shaft means, said shaft being axially movable between a pair of positions in response to energization and deenergization of said motor means; a switch actuatable either to energize or deenergize said motor means; indexing means movable with said shaft means; and lever means coupled with said switch to actuate the same, said lever means being engageable by said indexing means, when the latter reaches a predetermined position, to actuate the switch to deenergize the motor and to effect movement of its shaft to one of its said pair of positions, said shaft being releasably coupled with said switch to maintain the latter in its motor-deenergizing position in response to axial movement of the shaft upon deenergization of the motor means.

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