Aug. 16, 1932. A. E. ELLINGER 1,871,672

MECHANISM FOR SELECTIVELY CONTROLLING THE ANGULAR MOVEMENT OF A SHAFT

Filed Oct. 16, 1929 2 Sheets-Sheet 1

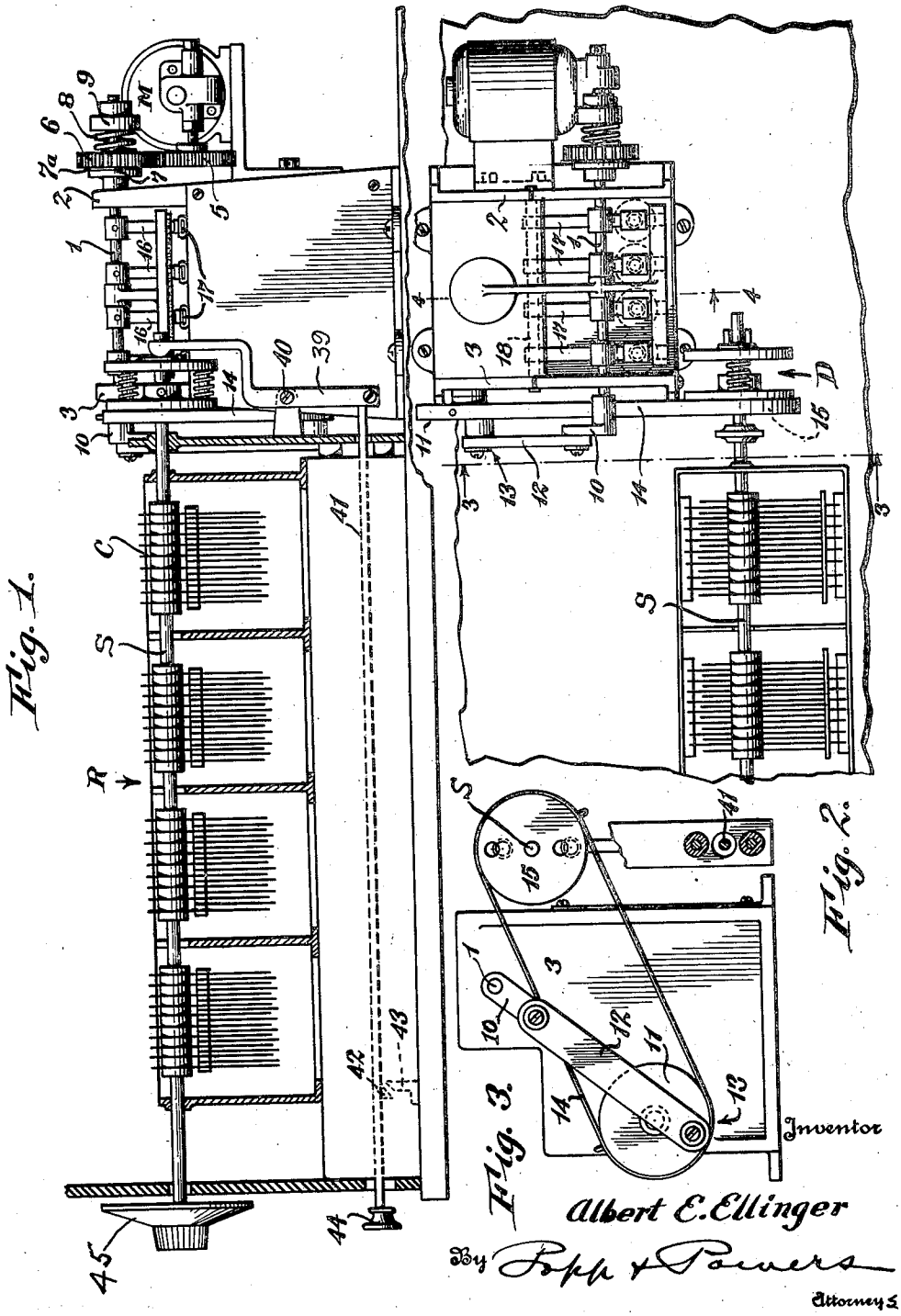


Fig. 1.

Fig. 2.

Fig. 3.

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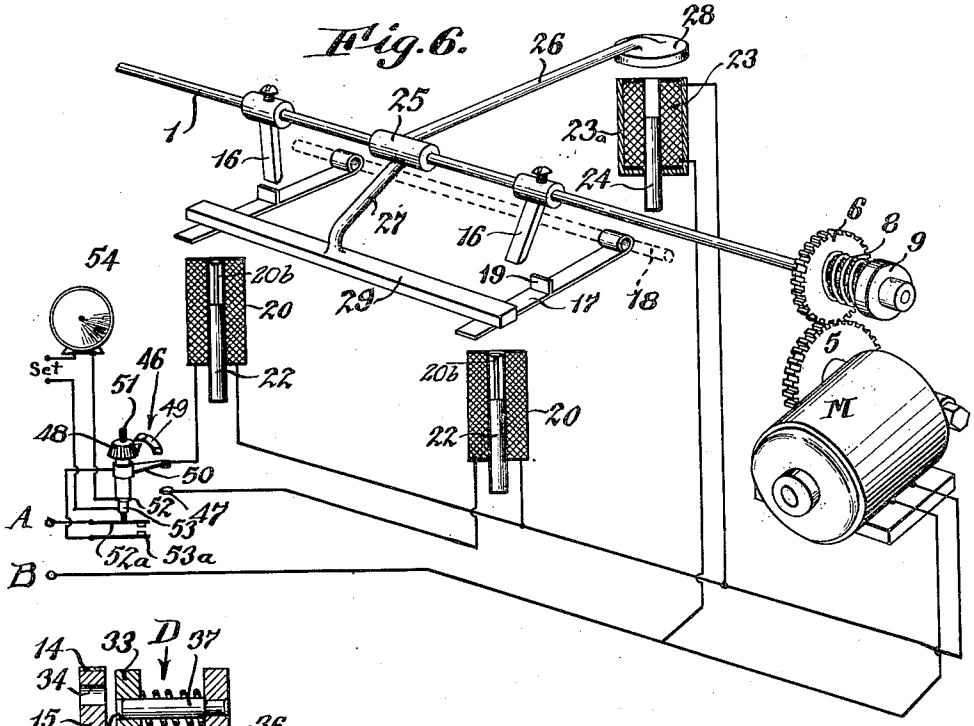
Attorneys

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Fig. 6.



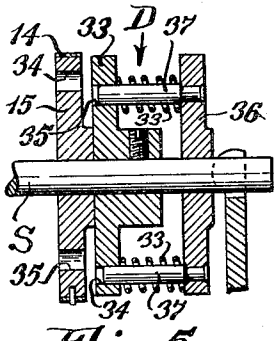


Fig. 5.

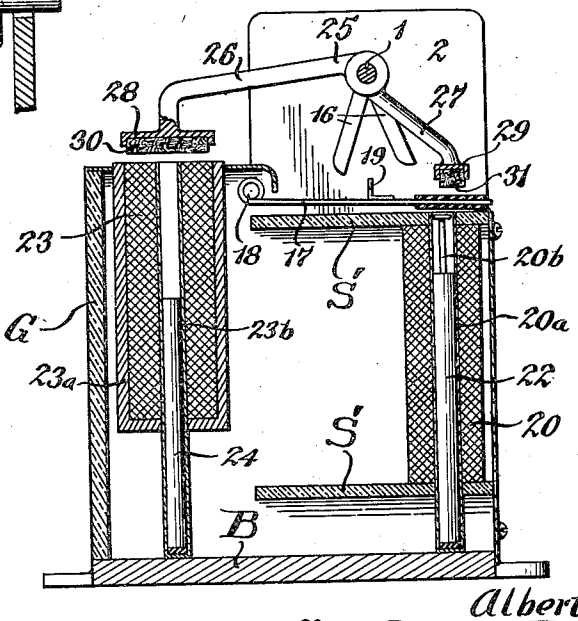


Fig. 4.

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UNITED STATES PATENT OFFICE

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MECHANISM FOR SELECTIVELY CONTROLLING THE ANGULAR MOVEMENT OF A SHAFT

Application filed October 16, 1929. Serial No. 400,142.

This invention relates to a mechanism for effecting the angular movement of a shaft to any one of a number of predetermined positions and in particular to improvements in mechanisms of the kind disclosed in my copending applications, Serial No. 340,759, filed February 18, 1929, Serial No. 354,375, filed April 11, 1929 and Serial No. 385,831, filed August 14, 1929. The mechanisms illustrated in the above cited applications all include a shaft mounted for angular movement, a series of independently operable latching means for said shaft, each being adapted to stop it at some predetermined position and a switch adapted to control the operation of the motor and said latching means.

The principal object of the present invention is to provide a mechanism of the type described which will be simple in construction, economical to manufacture and which will eliminate certain parts heretofore employed.

This object contemplates an improved drive mechanism and proposes, as in two of my previous applications, an oscillatory movement of the controlled elements but unlike said applications proposes a continuous rotary movement of the drive shaft which is to be locked against movement at certain predetermined points.

The mechanism is further simplified by arranging the latching elements in such a manner that they may be operated by vertically positioned solenoids as distinguished from prior constructions utilizing horizontally positioned solenoids. This arrangement has the advantage that the plungers operated by the solenoids return to their original positions after use by gravity and it is therefore unnecessary to provide means, such as springs or the like, to obtain this result.

The invention is illustrated in the accompanying drawings in which:—

Figure 1 is a side elevation of the mechanism as applied to a radio set.

Figure 2 is a top plan view of the same.

Figure 3 is a section along line 3—3 of Figure 2.

Figure 4 is an enlarged sectional view taken along line 4—4 of Figure 2.

Figure 5 is a detail view of the positive clutch which is an element of the mechanism.

Figure 6 is a diagrammatic view of the mechanism and the control arrangement therefor. In this view the mechanism to be controlled and the clutch between the controlling mechanism and the controlled mechanism have been omitted in order to enable the controlling mechanism to be more clearly shown.

The invention, as illustrated, includes a control mechanism, a controlled mechanism and an operative connection between the two which permits manual adjustment of the controlled mechanism without the necessity of operating any part of the control or driving mechanism.

The control mechanism includes a shaft 1, the angular movement of which is governed in the manner hereinafter described and which is adapted to impart to a part operatively connected thereto predetermined angular movements. This shaft is supported in suitable bearing standards 2 and 3, it being understood, of course, that by controlling the movement of the shaft 1, the part operatively connected thereto is automatically affected.

The control mechanism, although suitable for other uses is shown for purposes of illustration operatively connected to a radio set R, the controlled mechanism therefore includes the shaft S upon which the tuning elements C of the set are mounted.

The movement of the shaft 1 is preferably effected by a motor M to which it is connected through gears 5 and 6. The gear 6 is loosely mounted on the shaft 1 and constitutes the driving member of a friction clutch. It is resiliently pressed against the driven member 7 of the clutch which is fixed to the shaft 1 by a spring 8, which spring is held under compression between the gear 6 and a collar 9. A friction disc 7*a* may be interposed between the driving and driven members 6 and 7 respectively of the clutch. By virtue of this construction, as the motor drives the gear

6, the pressure exerted on the clutch member 7 through the friction disc 7a will cause the shaft 1 to rotate until it is locked against movement, at which time the clutch permits continued operation of the motor without possibility of breaking any of the parts of the mechanism. Inasmuch as the tuning condensers are ordinarily limited to movement within a tuning range which is generally 180° more or less, it is preferred to arrange the drive so as to oscillate the shaft S carrying the condensers within limits sufficient to cover this range. The oscillatory movement is preferably obtained by interposing a translating device between the shaft 1 and the shaft S whereby rotation of the shaft 1 imparts an oscillatory movement to the latter.

The translating mechanism is preferably mounted upon the bearing standard 3. It consists of a crank 10 fixed to the outer end of the shaft 1, a pulley 11 and a link 12 connecting the crank 10 to the pulley 11 at a point adjacent its periphery as at 13. The distance from the center of the shaft 1 to the point of connection between the crank 10 and link 12 is relatively less than the distance between the center of the pulley 11 and its point of connection with the other end of the link 12. A rotary movement, therefore, of the crank 10 effects an oscillatory movement of the pulley 11. This oscillatory movement is transmitted to the controlled shaft S upon which the tuning elements of the radio set are mounted by means of a belt 14 which connects the drive pulley 11 with a driven pulley 15 carried by the shaft S. In this type of translating device, the angle of oscillation of the driven member is somewhat limited, an angle of from 145° to 150° being the most practical, and, in order to move the shaft S throughout the tuning range which, as mentioned heretofore, generally is in the neighborhood of 180°, the driven pulley 15 on the shaft S is preferably suitably smaller than the driving pulley 11.

The shaft 1 may be locked against movement at any one of a number of predetermined positions. For this purpose a plurality of fingers 16, one for each predetermined position desired, are fixed to the shaft 1 and adapted for movement therewith. A corresponding number of latching elements are mounted for oscillatory movement on a shaft 18, the ends of which are supported in the standards 2 and 3. Each element 17 is adapted for independent pivotal movement toward and away from the shaft 1, to latching and unlatching positions with respect to its corresponding finger 16.

The latching elements are provided, preferably at a substantial distance from their outer ends with laterally projecting tangs 19 which are adapted at will to be raised into and lowered out of the paths of the fingers 16 during the rotation of the shaft 1, the latching elements 17 normally occupying an inoperative position.

The engagement between a finger and its corresponding latching element may, of course, be varied to take place at any desired predetermined angular position of the shaft by adjusting the finger about the shaft 1 to the position at which it is desired that the latching element engage the same to stop the shaft.

The pivotal latching movement of each element 17 is effected by individual solenoids 20 while the pivotal unlatching movement of all the elements is effected by a common solenoid 23.

The solenoids 20 hereinafter termed the selector coils are mounted in any suitable manner. They are illustrated as arranged in operative positions beneath their respective latching elements upon a transverse supporting member S' suitably spaced from the base B of the housing G. Each solenoid is provided with a brass sleeve 20a and a plunger 22 is slidably mounted for vertical movement therein. A stem 20b is fixed to the upper end of each plunger and is adapted when the solenoid is in the deenergized position as shown to be contained within the brass sleeve 20a of the solenoid. However, when the solenoid is in an energized condition the plunger 22 is raised vertically within its solenoid to force the stem 20b out of the brass sleeve to engage and raise the latching element 17 into an operative position in which position the co-operating finger 16 will engage the tang 19 carried by the said latching element when the shaft 1 has been moved through the necessary angle. Upon deenergization of the solenoid the plunger 22 will return to its original position into the brass sleeve 20a.

A single solenoid 23 hereinafter termed the restoring coil is preferably utilized to return all of the latching members to an inoperative position. The restoring coil as illustrated in Figure 4 is suitably secured in a vertical position in the casing G. It is preferably encased within a steel sleeve 23a and like the selector coils is provided with a brass sleeve 23b. It will be observed, however, that the base of the restoring coil 23 is supported in a horizontal plane which is a substantial distance above the plane in which the bases of the selector coils are supported. The restoring coil is provided with a plunger 24 which in its normal position is offset from the center of the coil in a lowered position. The movement of the plunger 24, as stated, is utilized to effect the desired movement of the latching elements. For this purpose a rock member 25 is loosely mounted on the shaft 1 and is formed of two radially extending arms 26 and 27. The arm 26 extends toward the restoring coil 23 and is provided with a head 28 which overlies the

core of said coil adjacent its upper end. The cooperating arm 27 extends from the opposite side of the shaft in a direction toward the selector coils and carries at its outer end a transverse bar 29 which overlies the free ends of the latching elements 17. Both the head 28 carried by the arm 26, the transverse bar 29 carried by the arm 27 are preferably provided upon their undersides with sound deadening materials 30 and 31 respectively which prevent undesirable noises during the operation of the mechanism.

Upon the energization of the restoring coil 23 the plunger 24 is projected upwardly against the head 28 with a force sufficient to rotate the rock member 25 with a consequent downward movement of the bar 29, which downward movement unlatches any finger that may be engaged. It is to be noted that the normal position of the plunger 24 in its solenoid is a position in which its upper end is substantially in the same plane as the upper end of the solenoid. The excess upward movement of the plunger 24 to operate the rock arm 25 is a result of the momentum gained by the said plunger during its initial upward movement. It is thus apparent that upon the energization of the solenoid 23 its plunger is projected upwardly to actuate the rock member 25 but immediately returns to an inoperative position despite the fact that it is still energized and during which inoperative position the desired selector coil is adapted to function. The restoring coil is designed to provide a stronger magnetic force than any one of the selector coils in order that the rock member 25 may be operated to lower all of the latching members to an inoperative position even though one of the selector coils is energized and tends to raise one of the latching members. If it is desired to employ similar solenoids for both restoring and selector coils the same result may be reached by suitably proportioning the lengths of the arms 26 and 27 to provide the necessary leverage. The steel sleeve 23*a* encasing the restoring coil short circuits the magnetic lines of force created by the solenoid when it is energized and reduces the amount of current required by the solenoid and thereby avoids possibility of the same from burning out.

In the course of the use of the apparatus, it may happen that the operator will desire to tune the set to some wave length for which there is no corresponding selector cam and contact button. In this case, it would be necessary to operate manually the shaft S upon which the condensers are mounted. In order to make possible such manual adjustment without the necessity of operating the switch to dissengage and return the latching element used in the previous selection, to its initial position and without the necessity, after such operation, of rotating the shaft S against the resistance of the motor driving mechanism and the friction clutch between the motor M and the selector mechanism, I propose to employ a positive clutch D between the shaft S upon which the condensers are mounted and the shaft 1.

As heretofore stated, the shaft 1 is operatively connected to the shaft S by the belt 14 and driving and driven pulley 11 and 15 respectively. The pulley 15 is loosely mounted on the shaft S and constitutes the driving member of a clutch D as best shown in Fig. 5. A second disc 33 is fixed upon the shaft S adjacent the loosely mounted pulley 15. Both the loosely mounted pulley 15 and the fixed disc 33 are provided with holes 34 and 35 respectively, which are, as illustrated, out of registry but which may be registered in the present instance, by the rotation of the pulley 15 through an angle of 180°, this arrangement of the holes always insuring the connection of the fixed disc 33 to the loosely mounted pulley 15 at the same point during the operation of the clutch. A stud plate 36 is slidably mounted on the shaft S adjacent the fixed disc 33, which plate carries studs 37. The stud plate 36 is normally urged away from the fixed disc 33 by springs 38 which are preferably positioned about the said studs 37.

During the operation of the automatic selector mechanism the plate 36 and the studs carried thereby are maintained in an inward position in which the studs pass entirely through the holes 34 in the fixed disc 33 and engage their respective holes 34 in the pulley 15, this engagement being maintained by the upper end of a rock arm 39 suitably pivoted to the radio cabinet as at 40 and an operating rod 41 connected to the lower end of the arm. The arm 39 may be secured in this position by engaging the projection 42 carried by the rod 41 with the rear side of the upstanding latch member 43 by utilizing as a handle the knob 44 which preferably projects through the front panel of the casing of the radio set.

When it is desirable to tune the set manually, the clutch D may be released by disengaging the latch members 42 and 43 thereby permitting the springs 38 to expand sufficiently to withdraw the studs 37 from the holes 34 in the pulley 15, at which time the operator may tune the set to the desired wave length by adjusting manually the dial 45 of the set without the necessity of operating the driving mechanism.

The control arrangement is shown in Figure 6 and in order to simplify the drawings only two selector coils and companion parts are shown and the radio set and clutch connecting the same with the control shaft 1 have been omitted. The control arrangement, as illustrated, includes a multiple switch 46 having a series of contacts 47, one contact for each desired predetermined position. Each

selector contact 47 is connected in series with a corresponding selector coil between one side of a suitable source of energy (not shown) and one side of the driving motor M the other side of the motor being connected to the other side of the source of energy.

The switch 46 is preferably of the type disclosed in my copending application, Serial No. 385,831, filed August 14, 1929. In general, it includes on operating handle 48 of insulating material having a pointer which traverses a suitable indicating plate 49. The hub of the handle 48 carries a resilient contact arm 50, the outer end of which is adapted to slidably engage any one of the fixed contacts 47. The handle 48 is provided with a bore within which a stem 51 of suitable non-conductive material is slidably mounted. The upper end of the stem provides a button which may be pushed downwardly to close a circuit through contacts 52*a* and 53*a* which are normally separated. The handle extension is provided with a contact plate 52 and the stem 51 carries a contact 53 which normally engages the contact plate 52 to close a circuit through a loud speaker 54.

When the mechanism, herein shown, is conditioned for controlling the movement of the shaft 1 to any one of a number of predetermined positions, the shaft may be operated to the desired position by rotating the handle 48 of the selector switch to place the proper selector coil in the circuit and then depressing the stem 51 of the switch. It will be noted, that during the operation of the handle 51 to select the desired contact 47, no one complete circuit is closed but that one of the contacts 47 and its corresponding selector coil 20 are connected in series with the switch member 50. In order to complete the circuit through the contact 47, the stem 51 is depressed. During the initial downward movement of the stem 51 the contact members 52 and 53 are separated to break the circuit through the speaker, thereby eliminating reception from any stations having wave lengths which lie between the initial position and the desired position of the shaft and also to eliminate any undesirable noises in the speaker circuit caused by the starting of the motor.

The continued depression of the stem 51 closes the contact members 52*a* and 53*a*, at which time a circuit is closed through the A side of the line, contact members 52*a* and 53*a*, switch arm 50, the selected contact member 47 and its corresponding selector coil 20, restoring coil 23, motor M and out through the B side of the line. It will thus be obvious that the selector coil and restoring coil are energized simultaneously and for the same length of time. The restoring coil, however, is designed to provide an initial stronger magnetic force than any one of the selector coils and upon the depression of the stem 51, the plunger 24 of the restoring coil will be projected upwardly and due to the momentum received will continue a short distance beyond its normal vertical position when energized to bump against the head 28 of the rock member 25. This impact is sufficient to pivot the rock member 25 about the shaft 1 and by means of the bar 29 force all of the latch elements to an inoperative position, it being understood, however, that only one such element will be effected by this action, i. e. the element used in the previous selection. This initial action of the restoring coil is strong enough to overcome the action of the selector coil which is energized at the same time and will prevent its plunger from raising the latching element which it is to ultimately effect. The plunger 24 of the restoring coil after having bumped the head 28 will automatically, due to gravity, drop a short distance to its normal position when energized in which position the top of the plunger is substantially level with the top of its solenoid. This downward movement of the plunger 24 frees the head 28 of the rock member and permits the energized selector coil to operate and thereby raise the desired latching element 17 to position the tang 19 carried thereby in the path of a companion finger 16. In the meantime, the motor M rotates the shaft 1 and associated cams, the rotation of shaft 1 continuing until it reaches the predetermined position desired at which point the finger 16 moves into engagement with its cooperating latching element 17 to lock the shaft in such a position. The friction clutch permits the continued rotation of the motor which may be stopped at any time simply by releasing the stem 51. Upon the release of the stem 51 all circuits are deenergized. The deenergization of the selector coil 20 will not, however, cause the associated latching element 17 to return to its initial position. This element is prevented from returning to its original position by the friction between the element and the tang of its corresponding finger. The element will, however, be returned to its original position upon the operation of the stem 51 to close a circuit through any of the contact members 47.

When it is desired to move the shaft 1 manually, it is not necessary to return the latching element to its original position since the shaft 1 upon which the fingers 16 are mounted may be entirely disconnected from the shaft upon which the condenser elements are mounted by disengaging the elements of the clutch C by operating the knob 44 in the manner described.

Having fully described my invention, I claim:

1. The combination of mechanism having movable elements operated by a common shaft with mechanism for controlling the movement of said shaft comprising a second

shaft, means for rotating said second shaft, means connecting said first mentioned shaft with said second shaft whereby a rotary movement of the second shaft effects an oscillatory movement of said first mentioned shaft and the elements carried thereby, means arranged for movement with said second shaft, and manually controlled means for engaging said last mentioned means to stop said second shaft at a predetermined position.

2. The combination of mechanism having movable elements operated by a common shaft with mechanism for controlling the movement of said shaft comprising a second shaft, means for rotating said second shaft, means for connecting said first mentioned shaft with said second shaft whereby a rotary movement of the second shaft effects an oscillatory movement of said first mentioned shaft and the elements carried thereby, means arranged for movement with said second shaft, normally inoperative means adapted for engagement with said means to stop the angular movement of the second shaft at a predetermined position, and manually controlled means for effecting the angular movement of said second shaft and for rendering said normally inoperative means operative.

3. The combination of mechanism having movable elements operated by a common shaft with mechanism for controlling the movement of said shaft comprising a second shaft, means for rotating said second shaft, means connecting said first mentioned shaft with said second shaft whereby a rotary movement of the second shaft effects an oscillatory movement of said first mentioned shaft and the element carried thereby, means arranged for movement with said second shaft, an element operable for engagement with said means last mentioned to stop said second shaft at a predetermined point, another element operable for engagement with said means last mentioned to stop said second shaft at a different point, and means for selectively operating said elements.

4. The combination of mechanism having movable elements operated by a common shaft with a mechanism for controlling the movement of said shaft comprising a second shaft operatively connected to said first mentioned shaft, means for rotating said second shaft, members arranged for movement with said second shaft, latching elements arranged for engagement with said members to stop the angular movement of said second shaft at a predetermined position, a selector solenoid for each latching element adapted upon energization to urge a latching element toward an operative position with respect to its cooperating member, a restoring solenoid adapted when first energized to counteract the action of any selector solenoid which may be energized and to force all of said latching elements to an inoperative position, said restoring solenoid then becoming effective to permit the latching element selected, corresponding to the position desired, to move to an operative position, and means for energizing simultaneously and for the same period of time any one of said selector solenoids and said restoring solenoid.

5. The combination of mechanism having movable elements operated by a common shaft with a mechanism for controlling the movement of said shaft comprising a second shaft operatively connected to said first mentioned shaft, means for rotating said second shaft, members arranged for movement with said second shaft, latching elements arranged for engagement with said members to stop the angular movement of said second shaft at a predetermined position, a selector solenoid for each latching element adapted upon energization to urge a latching element toward an operative position with respect to its cooperating member, means operative upon the energization of any selector solenoid for preventing the operation of said selector solenoid and for unlatching the shaft from the previous position occupied and then permitting the operation of the desired selector solenoid, said means including a rock member mounted on said second shaft and a restoring solenoid for operating said rock member, and means for energizing simultaneously and for the same length of time any one of said selector solenoids and said restoring solenoid.

6. The combination of mechanism having movable elements operated by a common shaft with a mechanism for controlling the movement of said shaft comprising a second shaft, means for rotating said second shaft, members arranged for movement with said second shaft, latching elements arranged for engagement with said members to stop the angular movement of said second shaft at a predetermined position, a slector solenoid for each latching element, plungers slidably mounted in said solenoids and adapted when the solenoids are energized to operate said latching elements, a restoring solenoid for all of said latching elements having a plunger adapted when the solenoid is energized to first effect the unlatching of the shaft from the previous position in which it was locked and then to permit the plunger of the selected selector solenoid to effect the latching of the shaft in the new position desired, all of said solenoids being arranged in a vertical position whereby when de-energized their plungers return to an inoperative position by gravity.

7. The combination of mechanism having movable elements operated by a common shaft with mechanism for controlling the movement of said shaft comprising a second shaft operatively connected to said first mentioned shaft, means for angularly moving said second shaft, a member arranged for

movement with said shaft, a latching element arranged for engagement with said member to stop said shaft at a predetermined position, a selector solenoid for operating said latching element, means for rendering said selector solenoid temporarily ineffective when first energized, said means including a rock member having an extension which overlies said latching member and a second extension which overlies a restoring solenoid, said restoring solenoid occupying a vertical position and having a plunger adapted when the said solenoid is first energized to shoot upwardly and bump said second extension to raise the same and thereby lower the first mentioned extension on said latching element and prevent its operating solenoid from being effective to force said element into an operative position, and means for energizing simultaneously and for the same period of time both said selector solenoid and said restoring solenoid.

8. The combination of mechanism having movable elements operated by a common shaft with mechanism for controlling the movement of said elements comprising a second shaft operatively connected to said first mentioned shaft, means for angularly moving said second shaft, a member arranged for movement with said shaft, a latching element arranged for engagement with said member to stop said shaft at a predetermined position, a selector solenoid for operating said latching element and means for rendering said selector solenoid temporarily ineffective when first energized and to thereby permit the said second shaft to be unlatched from its previous position, said means including a rock member pivoted intermediate its ends, one of its ends being adapted to overlie said latching element and its opposite end extending over a restoring solenoid occupying a vertical position and having a plunger adapted when the solenoid is first energized to shoot upwardly and bump the extension of the rock member overlying the same to thereby effect a pivotal movement of said rock member to lower the other extension and force downwardly and hold in this position the said latching element, the said plunger then dropping a short distance to its normal position below its cooperating extension to thereby permit the rock member to rotate in the opposite direction and permit said selector solenoid to operate, and means for energizing simultaneously and for the same period of time both said selector solenoid and said restoring solenoid.

9. The combination of mechanism having movable elements operated by a common shaft comprising means for angularly moving said shaft, said means including a plurality of angularly movable members, means for rotating said members, latching elements arranged for engagement with said members to stop the rotary movement of said shaft at any one of a plurality of predetermined positions, a selector solenoid for each latching element adapted upon energization to urge its latching element toward an operative position with respect to a co-operating member, a restoring solenoid adapted when first energized to hold all of said latching elements away from their latching positions and then becoming effective while still energized to permit the latching element selected, corresponding to the new position desired, to move into an operative position and means for effecting the energization of any one of said selector solenoids and said restoring solenoid.

10. The combination of mechanism having movable elements operated by a common shaft comprising means for angularly moving said shaft, said means including a plurality of angularly movable members, means for rotating said members, latching elements arranged for engagement with said members to stop the rotary movement of said shaft at any one of a plurality of predetermined positions, a selector solenoid for each latching element adapted upon energization to urge its latching element toward and operative position with respect to a co-operating member, a restoring solenoid, a plunger arranged in said solenoid adapted when the said solenoid is first energized to effect the unlatching of the shaft from its previous position and then to permit the selected selector solenoid to effect latching of the shaft in the new position desired, said plunger assuming an inoperative position due to gravity when its solenoid is de-energized.

11. The combination of mechanism having movable elements operated by a common shaft, with mechanism for controlling the movement of said shaft comprising a plurality of angularly movable members, means for rotating said members, a connection between said members and said shaft whereby a rotary movement of the former effects an oscillatory movement of the latter and manually controlled means for selectively engaging said members to stop said shaft at any one of a plurality of predetermined positions.

In testimony whereof I affix my signature.

ALBERT E. ELLINGER.