March 8, 1932. C. L. HANEL 1,848,171

VARIABLE ELECTRICAL CIRCUIT CONTROLLING DEVICE

Filed Dec. 6, 1929 4 Sheets-Sheet 1

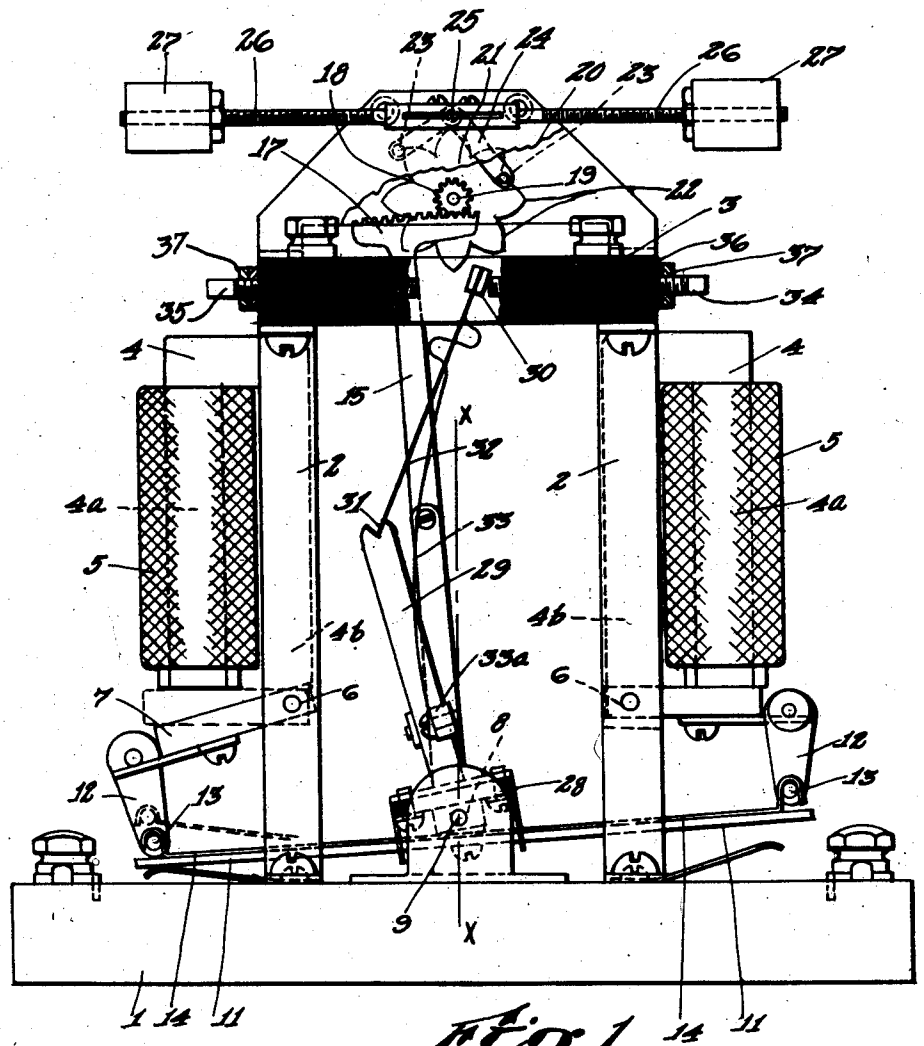


Fig. 1.

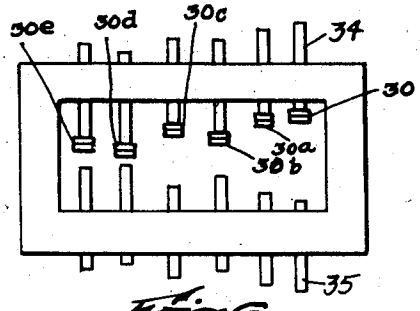


Fig. 6.

Inventor:
Charles Ludwig Hanel
By Orla N. Kennedy
Attorney

March 8, 1932. C. L. HANEL 1,848,171

VARIABLE ELECTRICAL CIRCUIT CONTROLLING DEVICE

Filed Dec. 6, 1929 4 Sheets-Sheet 2

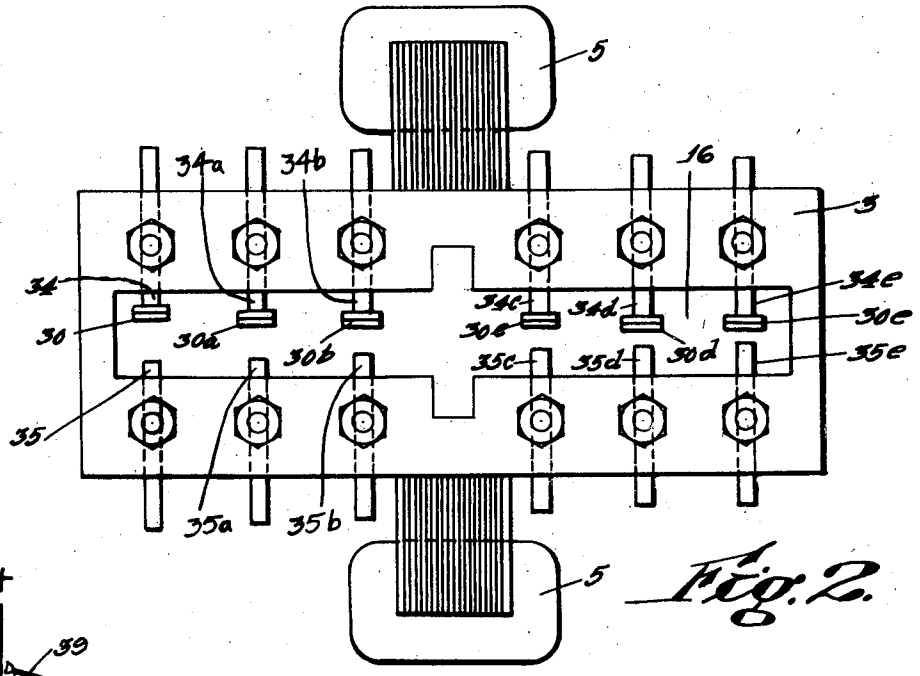


Fig. 2.

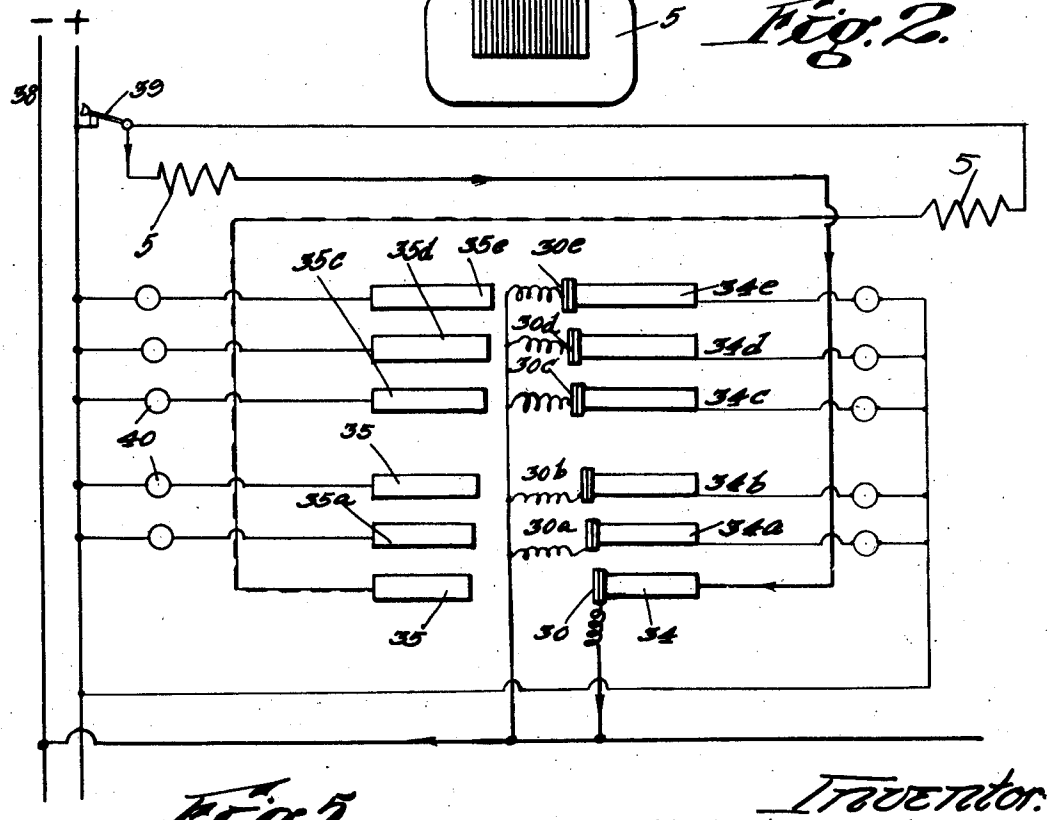


Fig. 5.

Inventor.
Charles Ludwig Hanel
By Owen N. Kennedy
Attorney

March 8, 1932. C. L. HANEL 1,848,171

VARIABLE ELECTRICAL CIRCUIT CONTROLLING DEVICE

Filed Dec. 6, 1929 4 Sheets-Sheet 3

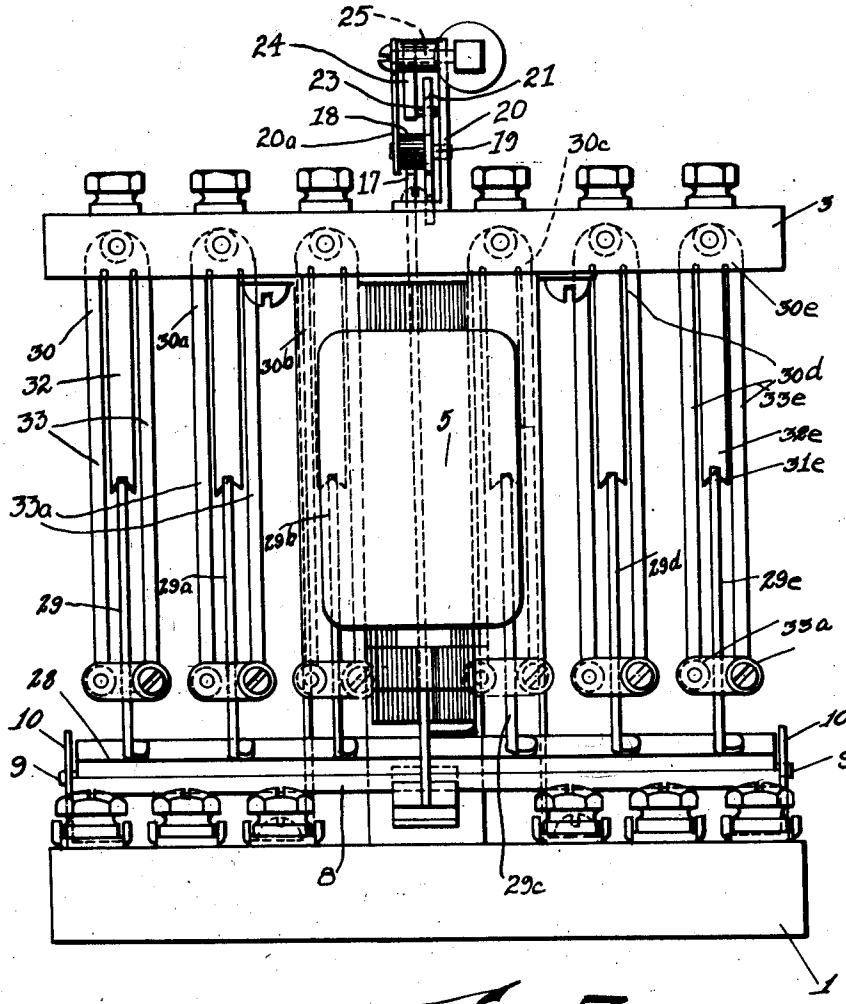


Fig. 3.

INVENTOR:
Charles Ludwig Hanel.
By
Owen N. Kennedy
Attorney

March 8, 1932. C. L. HANEL 1,848,171

VARIABLE ELECTRICAL CIRCUIT CONTROLLING DEVICE

Filed Dec. 6, 1929 4 Sheets-Sheet 4

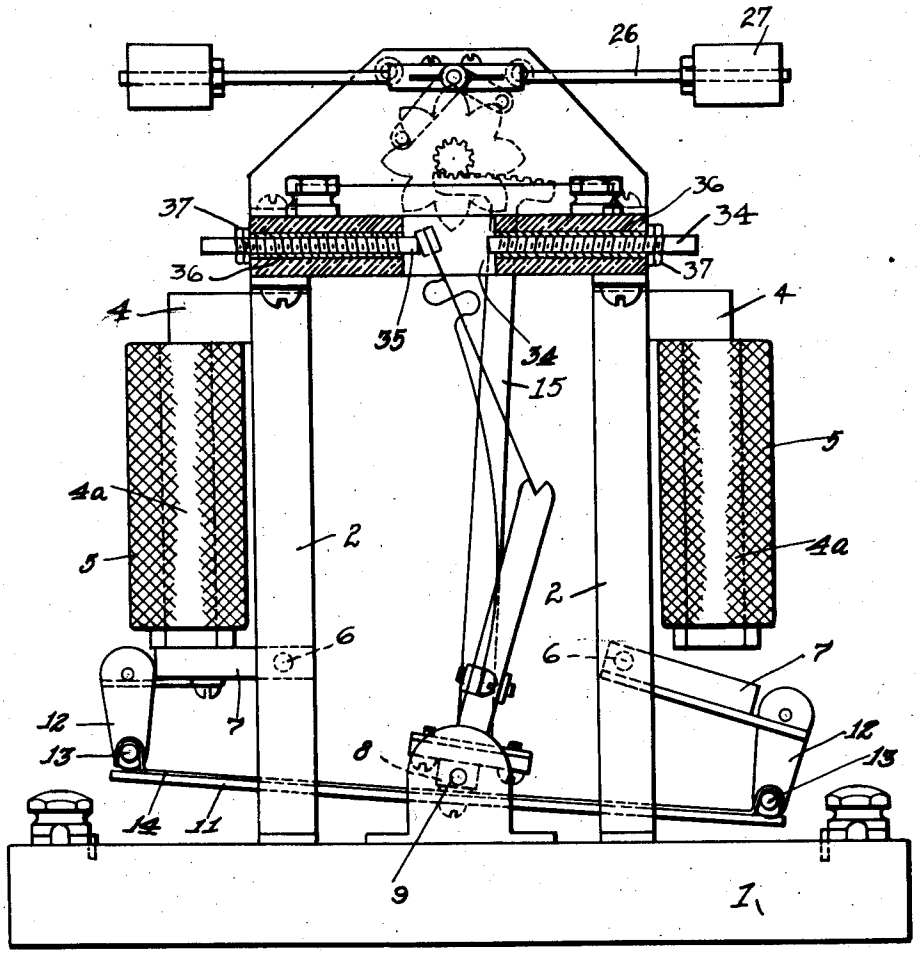


Fig. 4.

Inventor:
Charles Ludwig Hanel
By Owen W. Kennedy
attorney

Patented Mar. 8, 1932 1,848,171

UNITED STATES PATENT OFFICE

CHARLES LUDWIG HANEL, OF JACKSON HEIGHTS, NEW YORK, ASSIGNOR TO SIGNAL ENGINEERING & MANUFACTURING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF MASSACHUSETTS

VARIABLE ELECTRICAL CIRCUIT CONTROLLING DEVICE

Application filed December 6, 1929. Serial No. 412,147.

The present invention relates to electrical circuit controlling devices and has for its object to provide a circuit controlling device that is particularly characterized by its ability to variably control the energization of multiple electrical circuits, both as to the sequence of operation and as to the period of such energization.

The device of the present invention is particularly adapted for use in controlling the separate operation of various current consuming devices such as signals, or signs, in the operation of which it is desirable to have some variation both in the sequence in which the current consuming devices are energized, as well as in the different periods of time during which the energization is effected, the device maintaining any given sequence or timing when once it has been adjusted and being adapted to repeat its operation automatically as long as it is energized. The control of advertising signs or warning signals at a railroad crossing are obvious uses of the present invention, although it is susceptible of other uses, all as will hereinafter more fully appear from the following description with reference to the accompanying drawings, in which—

Fig. 1 is a view in front elevation of a device embodying the present invention, parts being broken away to show details.

Fig. 2 is a plan view of a portion of the parts shown in Fig. 1.

Fig. 3 is a view in side elevation of the device shown in Fig. 1, looking from the right hand side.

Fig. 4 is a view in front elevation similar to Fig. 1 illustrating the parts of the device in different positions.

Fig. 5 is a diagrammatic view illustrating the electrical circuit connections of the device with relation to the control of current consuming devices.

Fig. 6 is a fragmentary view based on Fig. 2 showing the device set to give a different operating sequence.

Like reference characters refer to like parts in the different figures.

Referring to the drawings, the device consists of a base 1 providing upwardly extending spaced standards 2, 2 supporting at their top a hollow rectangular frame 3 preferably composed of insulating material, as indicated by the sectioning in Fig. 1. Each standard 2 carries a magnetic yoke 4, U-shaped in form, the shorter leg 4*a* of each yoke being surrounded by a winding 5. The lower end of the longer leg 4*b* of each yoke provides a pivot 6 for an armature 7 and it is evident from Fig. 1 that the magnetic structure just described is duplicated for each standard 2.

A bar 8 is pivotally mounted midway between the standards 2 on a shaft 9 supported at its ends in bearings 10 provided by the base 1, the axis of the shaft 9 being parallel to the pivotal axes of the armatures 7, 7. The bar 8 carries midway between its supports by the bearings 10, a cross beam 11 which extends equally on opposite sides of the shaft 9 through the standards 2 and is symmetrically disposed with respect to the armatures 7, 7. The cross beam 11 terminates at its ends just below the armatures 7, 7 and each armature 7 is adapted to be yieldingly connected to the cross beam 11 by means of a link 12 pivotally connected to the armature at its outer end. The lower end of each link 12 provides a pin 13 around which is hooked one end of a spring element 14 paralleling the cross beam 11 and clamped at its middle portion between the beam 11 and the pivoted bar 8 so that the bar 8, cross beam 11 and spring 14 are in effect one member, although the spring 14 may be flexed independently of the beam 11.

In the position of the parts shown in Fig. 1, it has been assumed that the right hand winding 5 has been energized through circuit connections which will be hereinafter described, thereby attracting the right hand

armature 7 into engagement with the lower end of the short leg 4*a* of the core 4. In this position of parts, the upward movement of the armature 7, spring 14 and beam 11 having been completed, the spring element 14 is parallel with the cross beam 11 throughout its length, and the left hand winding 5 at that time being deenergized, the left hand armature 7 is maintained away from the short leg 4*a* of its core 4. It will be apparent however that should the right hand winding 5 be deenergized and the left hand winding 5 be energized, then the left hand armature 7 will be drawn upwardly about its pivot 6 and so flex the left hand portion of the spring element 14 away from the rigid left hand portion of the cross beam 11, as indicated in dotted lines in Fig. 1. When this occurs, the cross beam 11 is subjected to a force tending to turn it in a clockwise direction about the axis of the shaft 9 and since the pull of the left hand armature 7 is also transmitted to the bar 8 through the spring 14, the bar 8 will tend to turn until the parts occupy the position shown in Fig. 4, with the cross beam 11 and spring 14 again in parallel relation although having an inclination opposite to that shown in Fig. 1. In the above described swinging of the cross beam 11, it is obvious that turning movement of the bar 8 in either direction does not occur coincidently with movement of either armature 7 and the manner in which turning movement of the rocker bar 8 is controlled so as to always function uniformly will next be described.

As best shown in Fig. 1, the rocker bar 8 provides an arm 15 extending upwardly between the standards 2 into the space 16 provided by the insulating frame 3, the arm 15 terminating in a toothed sector 17. The teeth of the sector 17 are in engagement with a pinion 18 mounted on a shaft 19 mounted between a bracket 20 and plate 20*a* extending above the insulating frame 3, as shown in Fig. 3, the plate 20*a* being broken away partly in Fig. 1. The shaft 19 also carries an escapement wheel 21 turnable with the pinion 18, the teeth 22 of the wheel 21 being adapted to be engaged by pins 23 on a double pawl 24 pivotally mounted on a shaft 25 carries by the bracket 20 above and parallel to the shaft 19. The pawl member 24 has turnable therewith oppositely extending rods 26, 26 carrying weights 27 adjustable on the rods 26, it being obvious that the weights 27 acting on opposite sides of the shaft 25 will tend to assume a horizontal position in balance as shown in Fig. 1. However, should the left hand armature 7 be attracted by energization of its winding 5, the upward flexure of the spring 14 caused by the pin 13 lifting the free end of the spring will impart a turning movement to the rocker bar 8 with resulting swinging movement of the sector arm 15 from left to right, as viewed in Fig. 1.

As the arm 15 starts to swing, its sector 17 starts to rotate the pinion 18 which rotative movement is transmitted to the escapement wheel 22 in a counterclockwise direction. When this occurs, one of the teeth 22 engaging the left hand pawl pin 23 turns the pawl 24 about its pivot thereby swinging the alined rods 26 out of their horizontal position. Therefore, when the tooth engaging the left hand pin 23 releases the pin, the unbalanced force of the left hand weight 27, then in the dotted line position swings the pawl 24 in the opposite direction, thereby permitting the escapement wheel 21 to turn through the space of another tooth under the urge of the sector arm 15 upon which a force is exerted by the flexed spring 14. Obviously, the above described functioning of the escapement movement will continue with resulting oscillation of the pawl 24 until the rocker bar 8 has been turned enough to bring the left hand portion of the cross beam 11 into alinement with the spring 14, in which position the left hand armature 7 has completed its upward movement as indicated in full lines in Fig. 4. By this functioning of the escapement movement, it is obvious that following the attraction of either armature 7 by energization of the corresponding winding 5, the rocker bar 8 will be swung from one extreme position to the other with a slow measured turning movement governed by the oscillation of the pawl 24 so that a considerable time will elapse between the energization of a winding 5 and the completion of the resulting turning movement of the rocker arm 8. The manner in which this measured turning movement of the rocker bar 8 is utilized to control the making and breaking of a number of electrical circuits in a given sequence, as indicated diagrammatically in Fig. 5, will next be described.

As best shown in Figs. 1 and 3, the rocker bar 8 carries an insulating plate 28 upon which are mounted a plurality of upwardly extending arms 29, 29*a*, 29*b*, 29*c*, 29*d*, and 29*e*, with which are associated a series of resilient contacts 30, 30*a*, 30*b*, 30*c*, 30*d* and 30*e*, and since the arms 29, 29*a*, etc. and the contacts 30, 30*a*, etc. are identical, the construction and functioning of only the arm 29 and contact 30 will be described in detail. The arm 29 provides a notch 31 for receiving one end of a tongue 32 which, as shown in Fig. 3 forms part of the contact member 30, the tongue 32 extending nearly to the free end of the contact at its junction with spaced parallel fingers 33, the ends of which are anchored to the arm 29 at the lugs 33*a*. When the rocker bar 8 carrying the arm 29 is in the position shown in Fig. 1, with the arm 29 inclined to the left of a vertical plane *x*—*x* passing through the axis of the rocker bar shaft 9, the resilient central

tongue 32 exerts a thrust tending to hold the contact 30 in close engagement with a stationary contact 34 which is spaced from another stationary contact 35. The particular construction of the tongue 32 and fingers 33 carrying the contact 30 form no part of the present invention and is fully shown and described in my copending application Serial No. 291,441 filed July 9, 1928, although I preferably employ contacts of this type in the present mechanism in order to secure proper cooperation between the movable contact 30 and its associated spaced stationary contacts 34 and 35.

Let it now be assumed that the left hand winding 5 is energized to attract its armature 7 thereby flexing the spring 14 upwardly, as indicated in dotted lines in Fig. 1. This flexure of the spring 14 tends to turn the rocker bar 8 about its axis in a clockwise direction but, as previously pointed out, the turning movement of the rocker bar 8 takes place slowly owing to the functioning of the escapement device. As the bar 8 starts to turn in a clockwise direction, the arm 29 swings to the right from the position shown in Fig. 1 carrying with it the tongue 32 and when the apex of the notch 31 in the arm 29 moves past a line joining the point of engagement between the contacts 30 and 34 and the points of attachment of the fingers 33 to the arm 29, the thrust of the tongue 32 quickly throws the contact 30 to the left into engagement with the stationary contact 35. As this occurs, the reaction of the tongue 32 on the bar assists the flexed spring 14 in completing the turning movement of the rocker arm 8 under the control of the escapement so that the bar 8 finally moves to the position shown in Fig. 4 wherein the contact 30 is held closely in engagement with the stationary contact 35 by the thrust of the tongue 32 which is then acting oppositely with respect to the position shown in Fig. 1.

Referring now to Fig. 2, it will be seen that in addition to carrying the pair of spaced stationary contacts 34 and 35, the insulating frame 3 also carries a plurality of other pairs of contacts 34*a*, and 35*a*, 34*b* and 35*b* etc. corresponding to the number of arms 29, 29*a* etc. carried by the rocker bar 8. It will also be noted that the several pairs of contacts 34 and 35, 34*a* and 35*a*, 34*b* and 35*b* etc. are spaced apart different distances so that the contacts 30, 30*a*, 30*b* etc. associated with the arms 29, 29*a*, 29*b* etc. are adapted to be moved at spaced intervals as the rocker bar 8 is turned from one extreme position to the other, as shown in Figs. 1 and 4. In other words, when once the turning movement of the rocker bar 8 has been initiated by energization of the left hand winding 5 and the resulting flexure of the left hand portion of the spring 14, the resulting measured turning movement of the rocker bar 8 together with the arms 29, 29*a*, 29*b* etc. will cause the fingers 32 to move the contacts 30, 30*a*, 30*b* etc. in a regular sequence determined by the spacing between the various pairs of stationary contacts 34 and 35, 34*a* and 35*a*, 34*b* and 35*b* etc. As shown in Fig. 2 this spacing between the pairs of stationary contacts is progressively smaller beginning with contacts 34 and 35, so that it is obvious that the inclination of the resilient fingers 32 for the position of Fig. 1 is greatest for the contact 30 and smallest for the contact 30*e*. As a result the contacts 30*e*, 30*d*, 30*c*, 30*b*, 30*a* and 30 are moved in the order named, as the rocker bar 8 turns from the position shown in Fig. 1 to the position shown in Fig. 4.

As previously pointed out, the present invention also contemplates means whereby the operation of the circuit controlling devices may be varied and to this end the contacts 34 and 35, 34*a* and 35*a* etc. are all longitudinally adjustable in the insulating frame 3. As shown, this adjustment can be readily obtained by threading portions of the contacts 34 and 35 into suitable metallic bushings 36 provided by the frame 3, each contact 34 and 35 providing lock nuts 37 whereby they may be secured in any desired position. By adjusting the several sets of contacts 34 and 35, 34*a* and 35*a* etc. it is readily possible to vary the sequence of operation of the contacts 30, 30*a* etc., as desired and the advantage of such adjustment in controlling electrical circuits and current consuming devices will next be pointed out with reference to the diagrammatic showing of Figs. 5 and 6. Referring to Fig. 5, the operating windings 5, 5 are indicated as each having one terminal connected to the plus side of a suitable source of electrical energy indicated at 38 through a knife switch 39. The other terminal of the left hand winding 5 is connected to the stationary contact 34, while the other terminal of the right hand winding 5 is connected to the left hand stationary contact 35. The arm 29 carrying the contact 30 which cooperates with stationary contacts 34 and 35 is connected to the minus side of the source 38 so that should the knife switch 39 controlling the connection to the source 38 be closed with the parts occupying the position shown in Fig. 1 and indicated diagrammatically in Fig. 5, it is evident that the left hand winding 5 will be energized, the current then flowing from the stationary contact 34 to the movable contact 30 as indicated by the heavy circuit lines and arrows.

With the left hand winding 5 energized, the turning movement of the rocker bar 8 is initiated although current continues to flow through the left hand winding 5 as this movement progresses under the control of the escapment device. Since as previously noted, the spacing between the stationary contacts 34 and 35 is greater than the spacing between any other pair of contacts 34*a* and 35*b* etc.

it is obvious that the several contacts 30*e*, 30*d*, 30*c*, 30*b* and 30*a* will be snapped over in the order named before the contact 30 is finally separated from the contact 34. When the contact 30 is finally moved into engagement with the stationary contact 35 upon completion of the turning movement of the rocker bar 8, the left hand winding 5 is deenergized while the circuit of the right hand winding is completed through the contact 35, as indicated by the dotted circuit lines and arrows in Fig. 5. At this time, of course, the other contacts 30*a* to 30*e* inclusive are all then in engagement with the left hand series of stationary contacts 35*a* to 35*e* inclusive. Therefore upon energization of the right hand winding 5, the rocker bar 8 starts its turning movement in a counterclockwise direction from the position shown in Fig. 4 so that the contacts 30*a* to 30*e* inclusive are operated in the same order in the reverse direction before the contact 30 is again moved back into engagement with the contact 34 to again energize the left hand winding 5. Obviously then, so long as the knife switch 39 is closed the rocker bar 8 will be oscillated back and forth with a measured movement, each complete oscillation thereof causing all of the contacts 30 to 30*e* inclusive to be moved in the same sequence first from the contacts 34, 34*a*, 34*b* etc. to the contacts 35, 35*a*, 35*b* etc. and then in the reverse direction.

For purposes of illustration, the two series of contacts 34*a* to 34*e* inclusive and 35*a* to 35*e* inclusive are shown connected to the plus side of the source 38 through current consuming devices such as lamps 40, although it is to be understood that other types of current consuming devices can be employed. The contacts 30*a* to 30*e* inclusive are shown as being connected in parallel to the minus side of the source 38 so that with the connection shown, the series of lamps 40 at the right will be illuminated in a given sequence independently of the lamps 40 connected at the left. Obviously, many variations can be made in the circuit connections from the contacts 34 and 35 and as previously pointed out the sequence of the energization of these contacts can be altered as desired by varying the distances between each pair of contacts 34*a* and 35*a*, 34*b* and 35*b* etc. as indicated in the fragmentary showing of Fig. 6 in which the sequence of movement is 30*d*, 30*e*, 30*b*, 30*c*, and 30*a*. When making such variations between these contacts the only essential requirement is that the space between the contacts 34 and 35 which are connected to the windings 5 shall be greater than the space between any other given pair of contacts 34*a* and 35*a*, 34*b* and 35*b* etc.

From the foregoing then it is apparent that by my invention I have provided an extremely effective electrical circuit controlling device that is adapted to bring about the energization, or deenergization, of suitable current consuming devices in any desired sequence, the period of energization of each current consuming device also being adjustable within a given range.

I claim—

1. In a device of the class described, the combination with a pivotally mounted member and a plurality of stationary contacts arranged at different distances from the pivotal axis of said member, of a plurality of contact fingers carried by said pivoted member having contacts thereon at equal distances from the axis and means to procure a uniform turning movement of said member to cause engagement of said contacts on the fingers with said stationary contacts in a sequence determined by the different distances of said stationary contacts from the said pivotal axis.

2. In a device of the class described, the combination with an oscillatory member and a plurality of pairs of stationary contacts disposed at different distances from each other, of a plurality of contact fingers carried by said oscillatory member having contacts thereon at substantially equal distances from the axis of oscillation adapted to engage said contact members in a sequence determined by the spacing therebetween in response to oscillatory movement of said member.

3. In a device of the class described, the combination with a pivotally mounted member having a plurality of contact fingers mounted thereon, a plurality of stationary contacts arranged at different distances from the pivotal axis of said member and means to procure a slow turning movement of said member, of means for mounting said fingers on said member in such a manner that said fingers are moved with a quick motion into engagement with said stationary contacts in a sequence determined by the different distances of said stationary contacts from said pivotal axis.

4. In a device of the class described, the combination with a pivotally mounted member carrying a plurality of yieldable contact arms and means for biasing said pivotally mounted member in one direction about its axis to maintain said contact arms against fixed contacts in different degrees of flexure, of means for imparting a slow turning movement of said pivotally mounted member in the opposite direction for causing said contact arms to be disengaged from said fixed contacts in a sequence determined by the different degrees of flexure of said yieldable contact arms.

5. In a device of the class described, the combination with a pivotally mounted member carrying a plurality of yieldable contact arms and means for biasing said pivotally mounted member in one direction about its axis to maintain said contact arms against

fixed contacts in different degrees of flexure, of means for exerting a force tending to turn said pivotally mounted member in a direction opposite to that in which it is biased and an escapement device cooperating with said pivotally mounted member to cause turning movement in response to said force to take place slowly, whereby said contact arms are disengaged from said fixed contacts in a sequence determined by the different degrees of flexure of said contact arms.

CHARLES LUDWIG HANEL.