Aug. 30, 1932. C. L. HANEL 1,874,100

SELECTIVE ELECTRICAL CIRCUIT CONTROLLING DEVICE

Filed Dec. 9, 1929 3 Sheets-Sheet 1

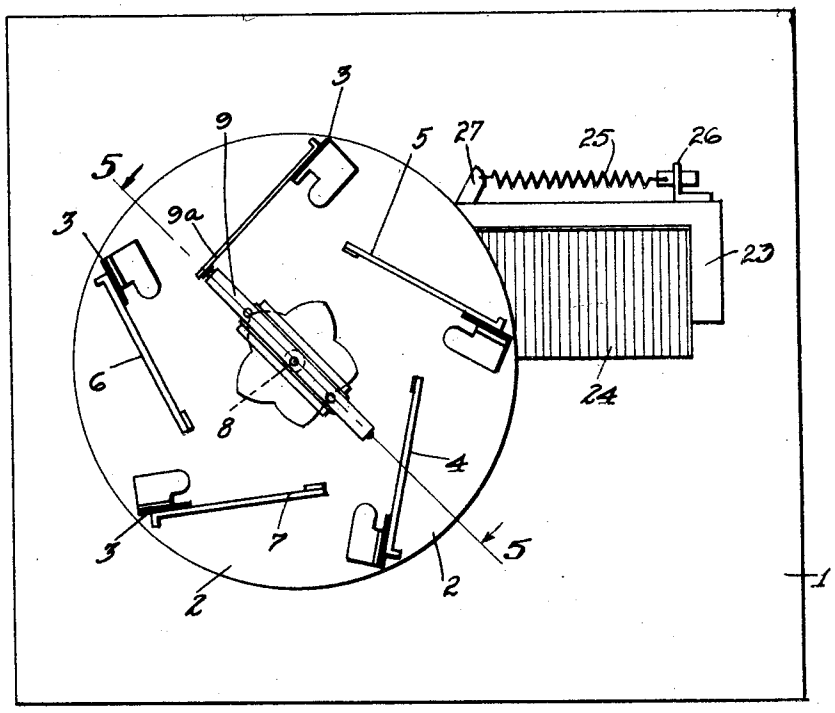


Fig. 1.

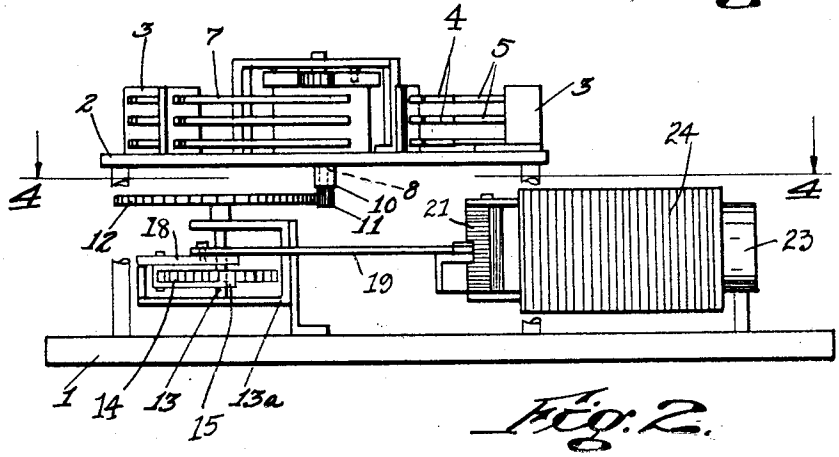


Fig. 2.

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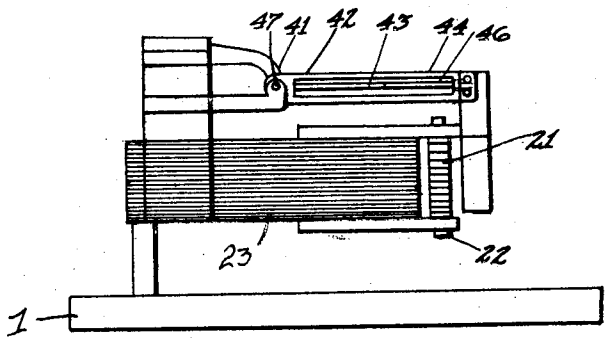


Fig. 3.

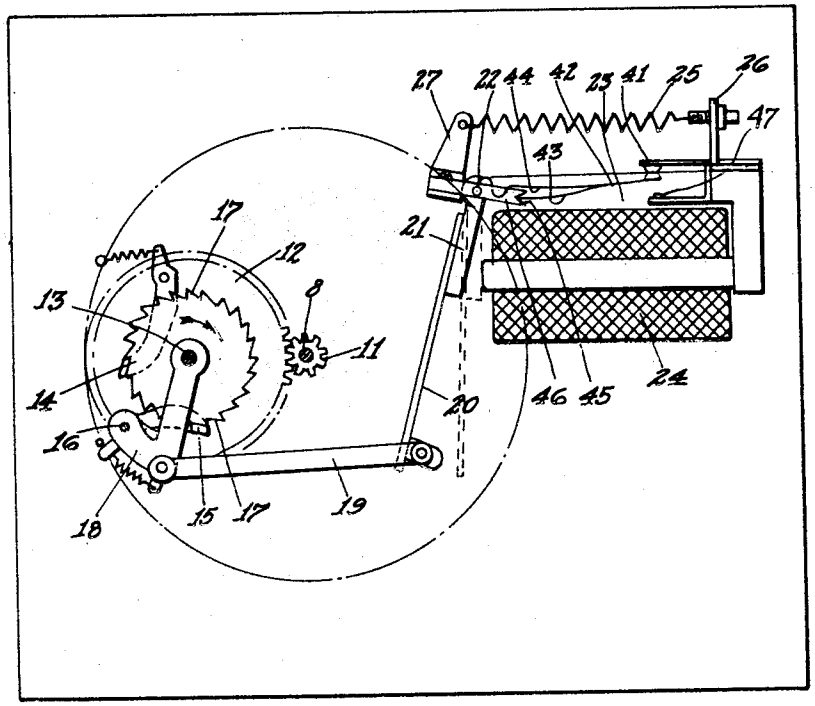


Fig. 4.

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SELECTIVE ELECTRICAL CIRCUIT CONTROLLING DEVICE

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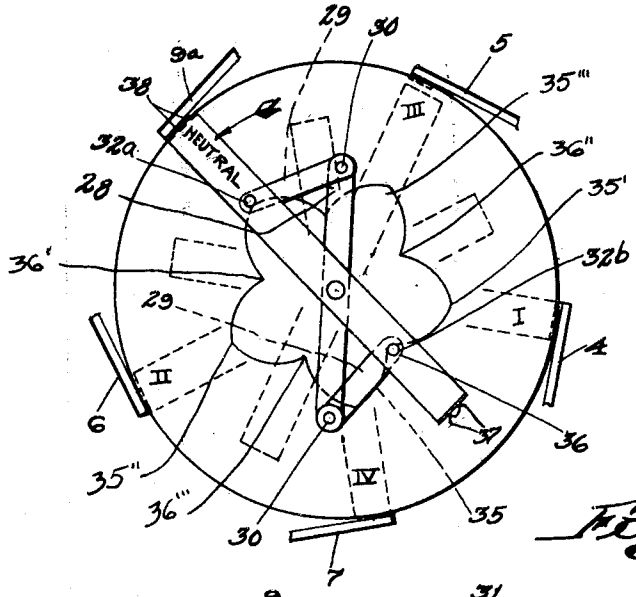


Fig. 6.

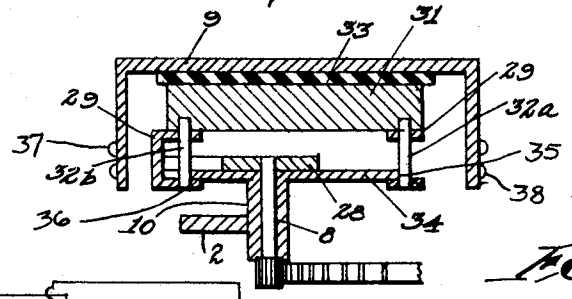


Fig. 5.

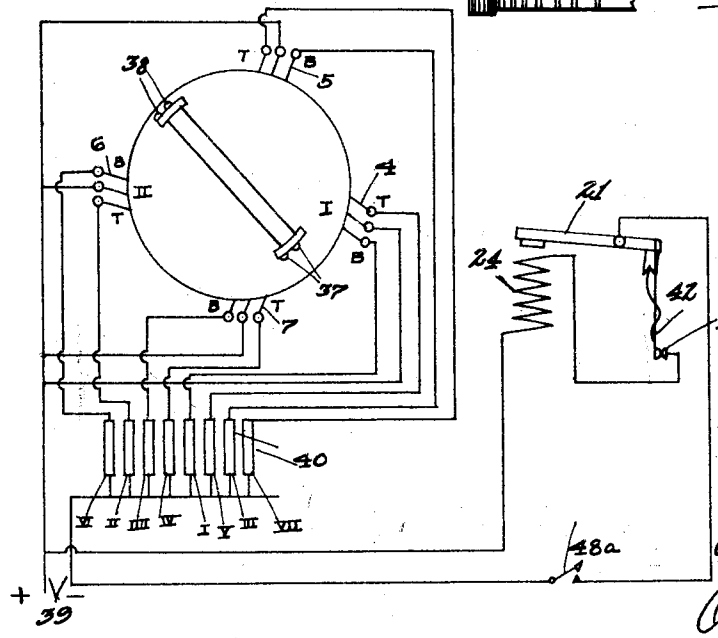


Fig. 7.

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Patented Aug. 30, 1932

1,874,100

UNITED STATES PATENT OFFICE

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SELECTIVE ELECTRICAL CIRCUIT CONTROLLING DEVICE

Application filed December 9, 1929. Serial No. 412,815.

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 selectively control the energization of a number of electrical circuits so that each complete operating cycle of the device will cause the electrical circuits under its control to be energized in an irregular, or selective manner.

The device of the present invention is particularly adapted for use in controlling the separate operation of a number of current consuming devices such as signals or signs, the control of warning signals at a railroad crossing being an advantageous use of the improved device, inasmuch as it is possible by my device to cause a flash of light apparently to travel in an irregular or zigzag path, so that it will readily attract attention. Obviously the device of the present invention is also susceptible to 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 plan view of the device embodying the invention.

Fig. 2 is a view in side elevation of the device shown in Fig. 1.

Fig. 3 is a view in side elevation of a portion of the device looking at the opposite side from Fig. 2.

Fig. 4 is a horizontal sectional view along the line 4—4 of Fig. 2, looking in the direction of the arrows.

Fig. 5 is an enlarged vertical sectional view along the line 5—5 of Fig. 1, looking in the direction of the arrows.

Fig. 6 is an enlarged plan view, illustrating the functioning of the device in different positions, parts being broken away to show the construction.

Fig. 7 is a diagrammatic view showing the electrical circuits controlled by the operation of the device.

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

Referring first to Figs. 1 and 2, the device comprises a base 1 above which is supported a circular plate 2 carrying a series of insulating blocks 3, 3. The insulating blocks 3 in turn support several groups of contact fingers 4, 5, 6 and 7, the free ends of which are circumferentially arranged with relation to the axis of a shaft 8 extending through the center of the contact carrying plate 2. Rotative movement of the shaft 8 is imparted to a contact bar 9 which is adapted to cooperate with the several sets of contact fingers 4, 5, 6 and 7 to bring about energization of the various contacts 4, 5, 6 and 7 with a selective or irregular movement in a manner which will hereinafter appear.

As best shown in Figs. 2 and 4, the shaft 8 is rotatably supported in a bearing 10 carried by the plate 2 and its lower end carries a pinion 11 in mesh with a gear 12 carried by a countershaft 13 rotatably supported by the base 1 in bracket 13*a*. As best shown in Fig. 4, the shaft 13 also carries a ratchet wheel 14 turnable with the gear 12 and a pawl 15 pivotally mounted at 16 is adapted to engage the teeth 17 of the ratchet wheel 14 and turn it in a clockwise direction, as indicated by the arrow. An oscillatory movement is adapted to be imparted to the pawl 15 by means of a rocker arm 18 turnable freely on the shaft 13, and the arm 18 is connected by a link 19 to an extension 20 provided on an armature 21 forming part of an electro-motor means for driving the device.

The armature 21 is pivoted at 22 on one leg of a U-shaped magnetic core 23 mounted on the base 1, the other leg of the core 23 carrying a winding 24. When the winding 24 is deenergized, the armature 21 is held away from the energizing leg of the core by means of a spring 25 adjustably secured at one end to a lug 26 carried by the base 1 and secured at its other end to a lug 27 projecting from the armature 21 beyond the pivot 22. The spring 25 pulling on the lug 27 tends to turn the armature 21 in a clockwise direction about its pivot 22 and thus causes the pawl 15 to tend to turn the ratchet wheel 14 and its associated gear 12 in a clockwise direction as viewed in Fig. 4. As shown, the spring 25 has just turned the ratchet wheel 14 through the distance of one tooth 17, so that should

the winding 24 be energized to attract its armature 20 and move it to the dotted line position, the pawl 15 will be stepped back through the distance of one tooth without imparting movement to the ratchet wheel 4 and shaft 13. Consequently, should the winding 24 be again deenergized in a manner hereinafter described, the spring 25 will again turn the ratchet wheel 14 through the space of one tooth and this turning movement of the shaft 13 will occur each time the winding 24 is energized and then deenergized.

As previously pointed out, the shaft 8 about which the contact bar 9 is adapted to turn is operatively connected to the pawl operated shaft 13 by means of the pinion 11 and gear 12 and the ratio of this gearing is such that when the ratchet wheel 14 is turned through the distance of one tooth upon movement of the armature 21 by the spring 25, the shaft 8 will be turned through one half of a revolution, although obviously other gear ratios may be employed. This intermittent rotative movement of the shaft 8 is utilized to impart a combined rotative and rectilinear movement to the contact bar 9, whereby to cause its cooperation with the fingers 4, 5, 6 and 7 in an irregular, or selective, manner through mechanism which will next be described.

As best shown in Figs. 5 and 6, the shaft 8 carries at its upper end a double crank member 28 extending equally on opposite sides of the shaft 8, the free ends of the crank member carrying links 29 pivotally connected to the crank 28 by pins 30. The opposite ends of the links 29 support between them a block 31 connected to the links 29 by pins 32*a* and 32*b*, so that the links support the block 31 with provision for relative pivotal movement therebetween. The block 31 serves to support the contact bar 9, a plate 33 of insulating material being interposed between the bar 9 and the block 31 so that the contact bar 9 is electrically insulated from the remainder of the apparatus. The pins 32*a* and 32*b* which serve to support the block 31 at the ends of the links 29 also cooperate with a cam 34 carried by the upper portion of the bearing 10 of the shaft 8 so that the cam 34 is fixed with respect to the shaft 8. As best shown in Fig. 6, the cam 34 provides a series of equally spaced and similarly formed projections 35 and depressions 36, the arrangement of which is such that a line joining the tip of any projection 35 with the innermost point of a recess 36 diametrically opposite will pass through the axis of the shaft 8. Consequently, when rotative movement of the shaft 8 is imparted to the crank arms 28, the pins 32*a* and 32*b* carried by the links 29 will ride on the surface of the cam 34 which will result in a combined rotative and rectilinear movement being imparted to block 31 and the contact bar 9 carried thereby.

As clearly shown in Fig. 6, when the pin 32*a* engages the tip of a cam projection 35 simultaneously with the engagement of the pin 32*b* with the bottom of a recess 36, the contact bar 9 is shifted to the right of the axis of the shaft 8, as viewed in Fig. 5 to swing the right hand end of the bar 9 to a point which lies on a circle including the several sets of contact fingers 4, 5, 6 and 7. In this particular position, however, there are no contact fingers in engagement with the end of the bar 9 and this position will hereafter be referred to as the "neutral" position to which the bar 9 returns at the end of each half revolution of the shaft 8. If desired suitable stops 9*a* may be employed at the "neutral" position, as indicated in Fig. 1, although the stops 9*a* do not carry any current.

It will be apparent from Fig. 6 that turning of the crank 28 from the neutral position shown will cause the pin 32*a* to travel into a depression 36′ of the cam while at the same time the other pin 32*b* will ride from a depression 36 to the tip of the cam projection 35′. As this occurs, obviously the block 31 carrying the contact bar 9 will be turned in a counterclockwise direction from the position shown in Fig. 6 and at the same time will be shifted to the left as viewed in Fig. 5 until it assumes the dotted line position designated position I, in which a pair of spaced bridging contacts 37 carried at one end of the bar 9 will engage two of the three contact fingers 4 with a sliding movement, the contact, however, being only momentary, due to the continued rotative movement of the crank arms 28. Further movement of these arms causes the pins 32*a* and 32*b* to impart a second combined rotative and rectilinear movement to the bar 9 to the position designated position II, in Fig. 6 in which a pair of spaced bridging contacts 38 carried at the opposite end of the bar 9 engage two of the three contact fingers 6 with a momentary sliding contact. Obviously, as the crank arms 28 complete a half revolution to return the bar 9 to its neutral position, facing in the opposite direction, the contacts 37 will engage the contact fingers 5 in position III and then the contacts 38 will engage the contact fingers 7 in position IV, the bar 9 finally coming to rest in a reversed position as compared to Fig. 5.

Therefore, it is obvious that when the shaft 8 is turned through another half revolution following deenergization of the winding 24, the bar will go through another cycle of movements into positions I to IV inclusive, only in making these movements the contacts 38 will engage the fingers 4 and 5 whereas the contacts 37 will engage the fingers 6 and 7 as contrasted to the preceding cycle of operation in which the sequence of movement of the contacts are in the reverse order. It is therefore apparent that each time the shaft

8 turns through a complete revolution there will take place a complete cycle of contact movements in which the fingers 4, 5, 6 and 7 will be selectively engaged by the contacts 37 and 38 carried by the bar 9. As an illustrative embodiment of the utility of this irregular operation of the contacts, reference will now be had to Fig. 7 which is a diagrammatic showing of the relation between the contact fingers 4, 5, 6 and 7 and contacts 37 and 38 carried by the bar 9.

In Fig. 7 the several sets of contact fingers 4, 5, 6 and 7 are shown displaced from each other in plan and arranged around the circumference of a circle whereas actually the contact fingers are arranged vertically, one above the other. Furthermore, the contacts 37 and 38 carried by the bar 9 are shown in plan to correspond with the diagrammatic showing of the contact fingers with which they cooperate and it is obvious that in position I as indicated, the contacts 37 will engage the bottom and middle contact fingers 4 whereas in position II the contacts 38 will engage the top and middle contact fingers 6. For convenience of designation, the contact fingers are labeled T and B to indicate top and bottom so as to make clear the sequence of the engagement of these fingers by these contacts 37 and 38. Therefore, as the bar 9 turns through a half revolution the contact fingers 4, 5, 6 and 7 will be engaged in the sequence of 4, 6, 5 and 7 and furthermore the bottom and middle fingers 4 and 5 will be engaged, whereas the top and middle fingers 6 and 7 will be engaged.

Still referring to Fig. 7, it will be seen that all of the middle fingers 4, 5, 6 and 7 are connected to the + side of a source of electrical energy indicated at 39, whereas the four pairs of top and bottom fingers 4, 5, 6 and 7 are connected to a corresponding number of current consuming devices indicated at 40. The other terminals of these devices 40 are connected in parallel to the − side of the source 39 so it is evident that whenever any top or bottom contact finger 4, 5, 6 and 7 is connected to its middle finger the corresponding current consuming devices will be energized momentarily. Therefore when the contact bar 9 makes a half revolution, the devices 40 will be energized in the sequence indicated by the numerals I, II, III and IV corresponding to the positions designated in Fig. 6. Also it will be evident that when the bar 9 completes the next half revolution, the remaining current consuming devices 40 will be energized in an entirely different order indicated by the numerals V, VI, VII and VIII. Obviously, this irregular energization of the current consuming devices 40 can be used in any desired manner for controlling signals, as for example, by causing the energization of discharge tubes to simulate a flash of lightning for use as a warning signal at a railroad crossing, in addition many other uses could be found for the device.

In the previous description, it has been assumed that the winding 24 controlling movement of the armature 21 has been intermittently energized and there will now be described means for automatically causing the intermittent energization of the winding 24 so that the shaft 8 will have an intermittent rotative movement imparted thereto. As also shown in Fig. 7, one terminal of the winding 24 is permanently connected to the + side of the source 39, whereas the other terminal thereof is connected to a stationary contact 41. As indicated, the contact 41 is engaged by a resilient contact 42 which is connected to the − side of the source 39 through a suitable switch 48. Consequently, with the contacts 41 and 42 in engagement and switch 48 closed, the winding 24 will be energized and the armature 20 attracted to cause the pawl 15 to be advanced the space of one tooth over the ratchet wheel 14. As shown in Fig. 4, the contact 42 is movable with the armature 21 and the turning movement of the armature 21 is utilized to disengage the movable contact 42 from the stationary contact 41 to automatically deenergize the winding 24.

A preferred way of accomplishing this automatic intermittent energization of the winding 24 is by employing the peculiar form of resilient contact shown in my copending application, Serial No. 291,441 filed July 9, 1928. As shown in Figs. 3 and 4, the resilient contact 42 provides a central tongue portion 43 separated from fingers 44 that are connected at their ends to the armature 21 adjacent its pivot 22 although insulated therefrom. The tongue 43 is joined to the fingers 44 only at the opposite ends of the fingers near the stationary contact 41 and the free end of the tongue 43 is received in a notch 45 provided in an arm 46 turnable with the armature 21.

When the winding 24 is deenergized, as indicated in Fig. 4, the spring 25 holds the armature 21 in the position shown, in which position the arm 46 is turned to bring the apex of its notch 45 at one side of the fingers 44. In this position the tongue 43 exerts a thrust tending to hold the contact 42 in close engagement with the contact 41. However, when the winding 24 is energized in response to this engagement between the contacts 41 and 42, turning of the armature 21 about its pivot 22 swings the arm 46 outwardly to throw the apex of the notch 45 to the opposite side of the fingers 44. When this occurs, the tongue 43 exerts a thrust tending to quickly separate the contact 42 from the stationary contact 41 and move the contact 42 into engagement with a stop 47. This has the effect of deenergizing the winding 24 so that the spring 25 is free to move the armature 21 away from the core 23 thereby causing the pawl 15 to turn the ratch-

et wheel 14 through the space of one tooth with the resulting turning of the shaft 8 through one half of a revolution. As previously pointed out, turning of the armature 21 away from the core 23 brings the parts to the position shown in Fig. 4 wherein the arm 46 has snapped the contact 42 back into engagement with the stationary contact 41, thereby again energizing the winding 24. It will therefore be apparent that so long as one terminal of the winding 24 is connected to the + side of the source 39 through the knife switch 48, the winding 24 will be intermittently energized and deenergized through the functioning of the resilient contact 42 and following each deenergization of the winding, the shaft 8 will be turned through one half of a revolution to cause energization of the current consuming devices 40 in the sequence designated I, II, III, IV in Fig. 7. Then when the spring 25 again causes the turning of the ratchet wheel 14 to turn the shaft 8 through another half revolution, consuming devices 40 will be energized in the sequence designated V, VI, VII, VIII.

From the foregoing, it is apparent that by the present invention there is provided an extremely simple and effective electrical circuit controlling device adapted to have an irregular or selective action as regards a number of different current consuming devices or circuits. The device is entirely automatic in its operation and will continue to energize the controlled circuits first in one sequence and then in another so long as one terminal of the operating winding is energized.

I claim,

1. In a device of the class described, the combination with a plurality of spaced contacts, of a movable contact arm and cam means for imparting a predetermined irregular movement to said arm to procure engagement of said contacts in predetermined irregular order.

2. In a device of the class described, the combination with a plurality of circularly arranged spaced contacts and a contact arm having contact points thereon and adapted to turn about the central axis of said contacts, of means for imparting a combined rotative and translatory movement to said arm alternately to move said contact points into the circle of the spaced contacts and to withdraw said points therefrom.

3. In a device of the class described, the combination with a plurality of circularly arranged spaced contacts and a contact arm having contact points on opposite ends thereof, said contact arm being adapted to turn about the axis of said contacts, of means for turning said arm through a predetermined angular movement and at the same time shifting said arm laterally with respect to its axis of rotation to procure first the engagement of the contact points on one end of said arm with one said spaced contacts, and then the engagement of the contact points on the opposite end of the arm with another of said circularly arranged spaced contacts during the rotation of said arm.

4. In a device of the class described, the combination with an uneven number of circularly arranged spaced contacts, and a contact arm having contact points arranged thereon and spaced apart a distance unequal to the diameter of the circle of said spaced contacts, of means for imparting a combined rotary and reciprocatory movement to said arm to move said arm contact points alternately into the circle of the spaced contacts for engagement successively with said spaced contacts.

5. In a device of the class described, the combination with a plurality of circularly arranged spaced contacts and a contact arm having contact points adjacent opposite ends spaced apart a distance unequal to the diameter of the circle of the contacts, said arm being adapted to turn about the central axis of said contacts, of means for imparting a combined rotative and reciprocatory movement to said arm to procure engagement of the contact points adjacent the opposite end with another of said spaced contacts at the other end of the reciprocatory movement.

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