Dec. 26, 1939. L. C. COBBETT 2,184,611

SWITCH

Filed Dec. 17, 1937 2 Sheets-Sheet 1

Fig. 1.

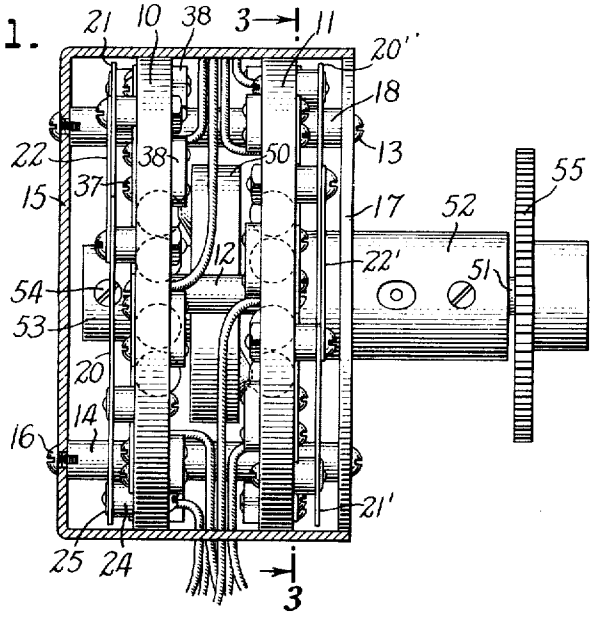


Fig. 2.

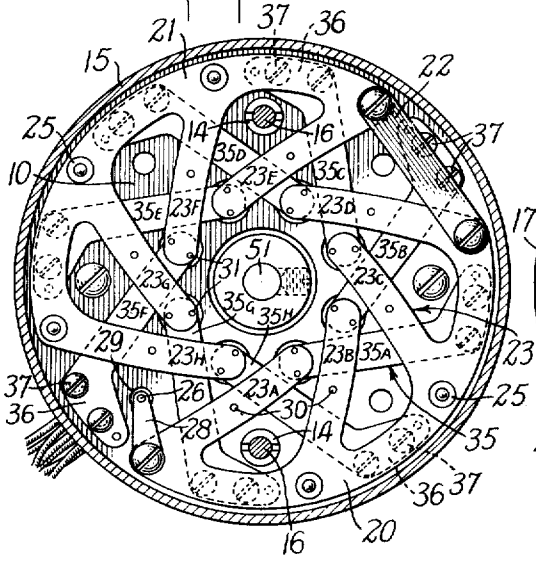
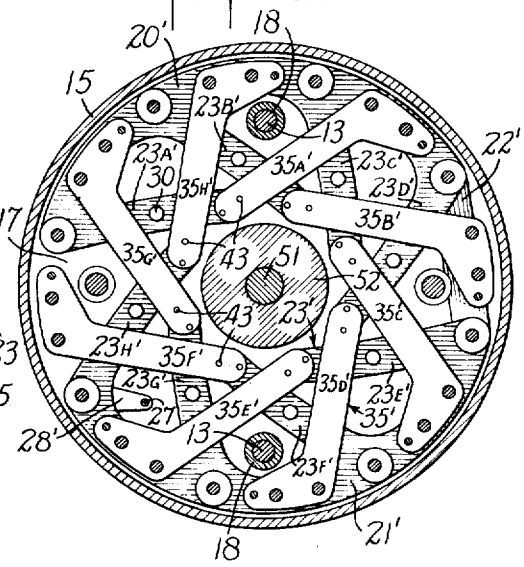


Fig. 3.



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Fig. 4.

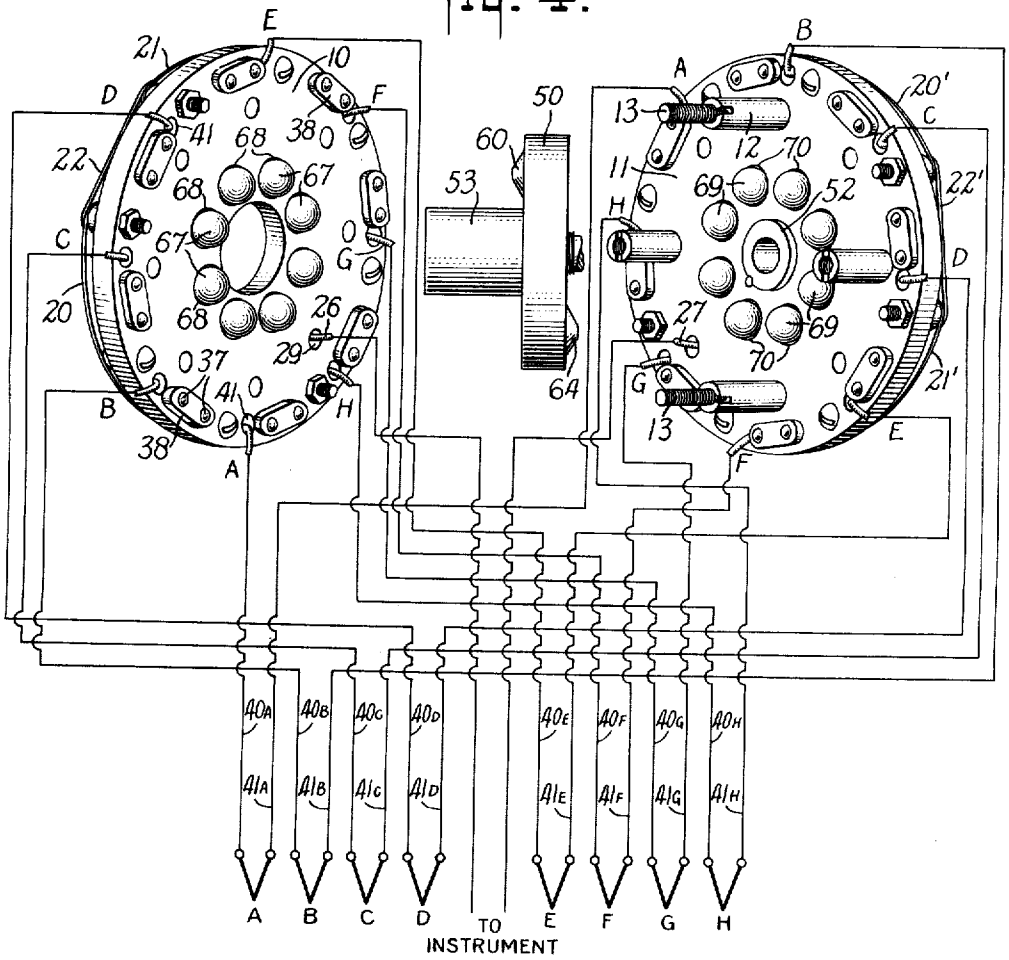


Fig. 5.

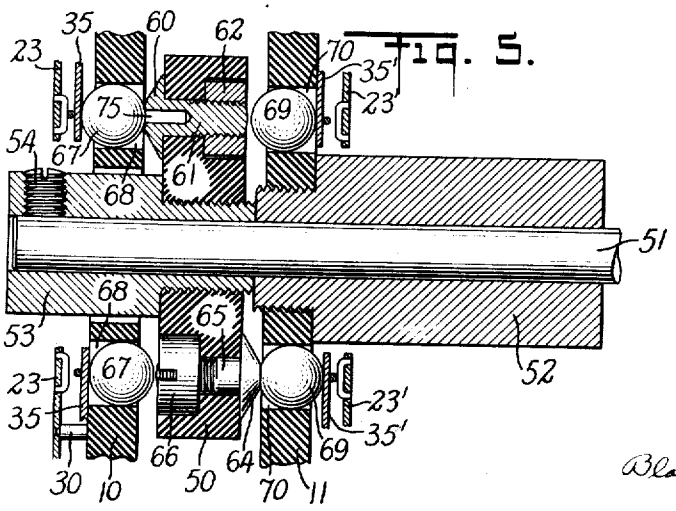
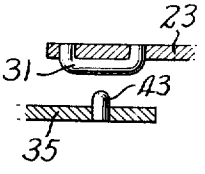


Fig. 6.



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SWITCH

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Application December 17, 1937, Serial No. 180,308

10 Claims. (Cl. 200—27)

This invention relates to improvements in electrical switch mechanisms and more particularly to switch mechanisms for connecting in serial manner a plurality of electrical circuits to a common circuit.

While not limited in its application, the switch mechanism of the present invention is particularly designed for use in connection with a multiple-potentiometer recording instrument, for the purpose of connecting into the main circuit of the instrument and in serial manner a plurality of electrical measuring circuits, each incorporating a thermocouple, whereby the different temperatures measured by the thermocouples may be indicated and/or recorded by the instrument.

Among the objects of the invention may be noted the provision of a switch mechanism for the above and other uses, which is relatively simple in manufacture and assembly, dependable and accurate in its action, which requires a minimum of power for its actuation, and which is self-cleaning and accordingly requires the minimum of attention over long periods of use.

Other objects will be in part obvious and in part hereinafter pointed out in connection with the following disclosure of an embodiment of the invention in detail.

In the drawings:

Figure 1 is a side elevation of the switch mechanism of the present invention, with the enclosing cover therefor being indicated in section;

Figure 2 is an end view of the switch mechanism illustrated in Figure 1, with the cover cut away and shown in section and looking from the left of Figure 1;

Figure 3 is a section along line 3—3 of Figure 1;

Figure 4 is an exploded view of the switch mechanism of the present invention, in which the electrical connections are diagrammatically shown; and

Figures 5 and 6 are details in section of certain parts of the switch mechanism.

Referring now to the drawings, wherein like reference characters designate like parts throughout the several views, reference characters 10 and 11 designate circular supporting discs of insulating material held in spaced relation by the spacing pillars 12 secured between the discs by the through bolts 13, (Figure 4) certain of which may extend through and beyond the leftwise disc 10 (Figure 1) to provide mounting for spacing pillars 14 by which the enclosing cover 15 is secured to the assembly as by cap screws 16. A circular guard plate 17 is held in spaced relation from the relatively outer face of the disc 11 as by pillars 18, the cover 15 and the guard plate 17 thus forming a housing within which is contained the discs 10 and 11 and the switch parts carried thereby.

Each of the discs 10 and 11 carries on its relatively outer face a spring contact assembly connected to one side of a common circuit, and a plurality of individual spring contact assemblies, each of which is connected to one side of a particular measuring circuit. Preferably the plurality of spring contact assemblies connected to the measuring circuits are arranged intermediate the outer faces of the discs and the two spring contact assemblies connected to the common circuit, and accordingly the latter assemblies will be referred to as the outer contact assemblies and the plurality of assemblies connected to the measuring circuits will be referred to as the under contact assemblies.

Referring now to the outer contact assembly as carried by the disc 10 and as illustrated in Figure 2, this is preferably comprised by two stampings 20, 21 of spring metal, the arcuate body portions of which extend along the periphery of the disc 10. The stampings 20, 21 are electrically connected by a jumper bar 22 and are each provided with a plurality of inwardly directed switch blades 23 which extend along converging arcs which intersect the arc of the peripheral or body portion of the stampings, the inner free ends of the blades lying on a circle struck from the center of the disc 10. The curvature of the blades increases their length and thus their flexibility, with the result that they may be flexed with a minimum of force.

The body portions of the stampings 20, 21 are secured to and spaced from the relatively outer face of the disc 10 by spacing bushings 24 through which suitable securing means such as rivets or grommets 25 may extend. The number of the switch blades corresponds to the number of the measuring circuits and, in the construction shown for purpose of illustration, are eight in number whereby to provide means for connecting the eight thermocouples A, B, C, D, E, F, G, H to a common circuit which is a circuit to the instrument (not shown). Accordingly the blades are designated 23A, 23B, 23C, 23D, 23E, 23F, 23G, 23H.

The stampings 20, 21 are of conductive metal, and the entire contact assembly is electrically connected to a conductor 26 leading to the instrument through a tang 28 secured to the stamp-

ing 20 and soldered or otherwise connected to the conductor, which passes through a suitable aperture 29 formed in disc 10. The switch blade portions 23 of the assembly are so mounted as to be flexible relatively outwardly, but are inwardly flexed, i. e., towards the face of the disc 10, such flexing being limited by means of inwardly projecting spacer pins 30 carried by each of the blades intermediate their ends. Referring to Figure 6, each blade at its inner end carries a contact 31 which extends from the under face of the blade and is disposed generally transversely of the length thereof. Preferably the contacts are each constituted by a length of wire of good conductive and wear resisting metal such as platinum-iridium alloy. The wire is bent into U-shape, with its legs set into holes provided in the end portion of the blade, and is thereupon secured to the blade as by soldering, as indicated in Figure 6.

The disc 11 carries on its relatively outer face a switch contact assembly substantially identical but transposed with respect to the assembly just described, and is constituted by the stampings 20', 21', jumper bar 22', and the switch blades generally designated 23' and individually referred to as 23A', 23B', 23C', 23D', 23E', 23F', 23G', 23H', this assembly being connected to the other lead 27 to the instrument through the tang 28'.

Referring now to the under spring contact assembly carried by the disc 10, this is constituted by eight spring metal stampings generally indicated at 35 to provide relatively long switch blades 35A, 35B, 35C, 35D, 35E, 35F, 35G, 35H, each extending from a base portion 36 fixed to a face of the disc by securing screws 37 threaded into the holding blocks 38 carried on the other face of the disc. The blade portion of each assembly extends inwardly but not radially of the disc 10, whereby its length is increased, and in such direction that its free end portion underlies the end of a converging switch blade of the outer assembly. The under contact assemblies are, like the outer assembly, of conductive metal and their base portions each are provided with an extension to which the leads 40A, 40B, 40C, 40D, 40E, 40F, 40G, 40H, to the thermocouples are connected, these leads passing through apertures 41 in the disc 10.

Although the switch blades 35 normally lie against the outer face of the disc 10, their free ends may be readily flexed outwardly, to engage against the free ends of the blades 23, due to their spring metal construction and their substantial length. Each of the switch blades 35 carries on its relatively outer face a contact 43 similar in construction to the contact 31, and extending in the direction of the length of a blade. Thus, by reference to Figures 5 and 6, the contacts 31 carried by the switch blades of the outer assembly are substantially at right angles to the contacts 43 carried by the under switch blades, and the spacing between the assemblies is such that the contacts are normally separated. With the blades 23 and 35 flexing about axes which are angularly inclined as shown in Figures 2 and 3, it will be seen that when one of the switch blades of an under assembly is flexed relatively outwardly to engage against and to cause outward flexure of the related blade 23 of the outer assembly, the contacts 31, 43 engage each other with a wiping action, with the result that the contacts are essentially self-cleaning. Further, by reason of their circular sections and intersecting relation, the contacts 31, 43 make substantially point contact which is maintained throughout the period of their engagement, irrespective of variations in the force required for their actuation, whereby the electrical contact made is substantially the same for each successive switch closing.

Disc 11 carries an under contact assembly substantially similar but transposed with reference to the under assembly as carried by the disc 10 and comprises the switch blade elements generally referred to as 35' and individually designated 35A', 35B', 35C', 35D', 35E', 35F', 35G', 35H'. The latter assemblies are connected through leads 41A, 41B, 41C, 41D, 41E, 41F, 41G, 41H, to the other side of the several thermocouples.

Considering now the means for actuating the switch in such manner as to connect successively the thermocouples into the common circuit 26, 27 of the instrument, reference is had to Figures 4 and 5 wherein 50 designates a rotor element arranged between discs 10, 11. The rotor 50 is driven by a spindle 51 which extends through a fixed bearing bushing 52 threaded into the disc 11, the spindle also extending through a hubbed bushing 53 threaded into the rotor, the spindle being secured to the bushing 53 as by a set screw 54. Spindle 51 through its gear 55 (Figure 1) is driven intermittently by any well known step-by-step movement and thus imparts periodic movement to the rotor 50. The arrangement is such that, at each partial rotation of the spindle 51, the rotor 50 is driven throughout an angle of 45°, whereby any one complete revolution of the rotor makes eight dwells, thus to correspond to the number of thermocouples.

On the face of the rotor 50 adjacent the disc 10 is arranged a camming device in the form of a conical head 60, the shank 61 of which extends into the rotor and is secured by the nut 62. Arranged on the other face of the rotor, i. e., the face adjacent the disc 11, and disposed 180° from the head 60 is a conical head or cam 64 whose shank 65 is similarly held in the rotor 50 by a nut 66.

The head 60 is adapted, upon rotation of the rotor 50, to engage successively a series of eight balls 67 carried in equidistantly spaced ball pockets 68 in the disc 10, with the head 64 similarly engaging a like series of balls 69 carried in ball pockets 70 of the disc 11. The ball pockets are formed by a circularly arranged series of apertures in each of the discs 10, 11, the pockets being disposed to underlie the crossed ends of the switch blades of the contact assemblies. The arrangement and proportioning of the parts is such that the balls 67 are normally loosely held in the pockets 68, being maintained therein by the under face of the spring blades 35 and by the adjacent face of the rotor 50. Similarly the balls 69 are loosely carried in the pockets 70 of disc 11. However, when the rotor 50 moves to a position in which diametrically opposed heads engage a pair of balls 67, 69, the latter are forced relatively outwardly by camming action of the heads against the overlying spring blades 35, 35', of the under assemblies and to a degree causing the free ends thereof to move against and flex outwardly the overlying spring blades 23, 23', of the outer assemblies. The contacts 43 and 31 of the so actuated spring blades thus engage with a wiping action, and in so doing electrically connect a pair of diametrically opposed under assemblies with the outer assemblies of the discs 10, 11.

Due to the opposed relation of the heads 60, 64, it will be seen that as contact is made between

one set of contacts 31, 43 of the assemblies carried by the disc 10, contact is simultaneously made between an opposed set of contacts of the switch assemblies carried by the disc 11. As the making of contact between one set of contacts 31, 43 as carried by disc 10 connects one of the instrument conductors with one side of a thermocouple, the arrangement herein provides that the simultaneous making of contact between the set of opposed contacts 31, 43 as carried by the disc 11 connects the other instrument conductor to the other side of that thermocouple, and consequently a thermocouple circuit is connected to the common instrument circuit.

Thus if we assume that the head 60 through ball 67 (Figure 4) is pressing switch blade 35A outwardly so that contact is established between switch blade 35A and the related switch blade 23A of the outer contact assembly, instrument lead 26 is electrically connected with the conductor 40A which forms one side of the circuit of thermocouple A. Simultaneously head 64 engages ball 69 to make contact between switch blades 23A' and 35A', thus to connect the conductor 41A, being the other side of the circuit of thermcouple A, with the instrument lead 27. The circuit of thermocouple A is now connected to the instrument circuit whereby the temperature measured by the thermocouple A may be indicated and/or recorded by the instrument. As the rotor 50 thereafter moves from its dwell position, the circuit of thermocouple A is disconnected from the instrument and upon its next period of dwell the rotor 50 connects the circuit of thermocouple B with the instrument circuit. Accordingly, as the rotor 50 makes one complete rotation the circuits of the thermocouples A, B, C, D, E, F, G, H, are serially connected in the instrument circuit for the time period of each dwell of the rotor as established by its intermittent drive.

The apices of the cone-shaped heads 60, 64 are cut away to provide flattened surfaces and one such surface is drilled as at 75 (Figure 5), to provide a centering seat for the balls 68. Hence, as the rotor comes to a position of rest with the head 60 engaging a ball 68, the ball is centered on the head and is thereafter maintained centered for the particular dwell period. However, the arrangement is such that the ball may readily unseat itself as the rotor commences its further movement, so that a quick separation of the contacts 31, 43 results and a minimum of force only is required to initiate the further movement of the rotor.

When the switch above described is used as a two-point or four-point switch as, for example, with a two or four record potentiometer recorder, the leftwise disc 10 and its associated parts may be eliminated. Referring to Figures 4 and 5, with such an arrangement, however, the cone-shaped head 60 is turned around to face in the same direction as the cone-shaped head 64 so that both cone-shaped heads are supported on the balls 69. With this operation, too, the connector 22' is eliminated and the stampings 20' and 21' then become the plus and minus connectors to the instrument.

As many changes could be made in carrying out the above constructions, without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a switch mechanism, in combination, a supporting base, a first contact assembly secured to the base and having a plurality of flexible convergently extending switch blades terminating on a common circuit with their longitudinal axes tangential thereto, a plurality of other contact assemblies secured to the base and providing flexible convergently extending switch blades spaced from switch blades of said first assembly and terminating on the common circle with their longitudinal axes tangential thereto and their convergent ends positioned opposite the convergent ends of the switch blades of the first mentioned assembly, means for moving the ends of one of said groups of blades into engagement with opposed ends of the other group of blades, and means for periodically engaging and actuating said blade moving means.

2. In a switch mechanism, in combination, a supporting base, a first contact assembly secured to the base and having a plurality of flexible convergently extending switch blades terminating on a common circle with their longitudinal axes tangential thereto, a plurality of other contact assemblies secured to the base and providing flexible convergently extending switch blades spaced from switch blades of said first assembly and terminating on the common circle with their longitudinal axes tangential thereto and their convergent ends positioned opposite the convergent ends of the switch blades of the first mentioned assembly, means for moving the ends of one of said groups of blades into engagement with opposed ends of the other group of blades, means for periodically engaging and actuating said blade moving means, and means effective between the ends of each blade of one of said groups of blades and interposed between said blades and said base to limit the extent of movement of said blades toward said base.

3. In a switch mechanism, in combination, a supporting base, an outer contact assembly carried by the base and spaced from a face thereof, the assembly including a body portion secured to the base and a plurality of flexible switch blades extending inwardly and terminating on a common circle, a plurality of under contact assemblies each related to but normally spaced from a switch blade of the outer assembly, the under assemblies each including a base portion secured to the base and a flexible switch blade extending inwardly and terminating on the common circle whereby the ends thereof underlie the ends of the switch blades of the outer assembly, the base being provided with a series of apertures arranged on the common circuit, each of which registers with a set of under and outer switch blade ends, means operatively disposed in said apertures for moving the ends of the blades of one of said assemblies into engagement with the adjacent ends of the blades of the other assembly, and means for periodically engaging and actuating said last-named means.

4. In a switch mechanism, in combination, a supporting base, an outer contact assembly carried by the base and spaced from a face thereof, the assembly including a body portion secured to the base and a plurality of flexible switch blades extending inwardly and terminating on a common circle, a plurality of under contact assemblies each related to but normally spaced from a switch blade of the outer assembly, the under assemblies each including a body portion secured to the base and a flexible switch blade

extending inwardly and terminating on the common circle whereby the ends thereof underlie the ends of the switch blades of the outer assembly the base having a series of apertures arranged on the common circle, each registering with a related pair of under and outer blade ends, a ball loosely carried in each of said apertures and adapted upon actuation to move the end of an under switch blade into engagement with the end of an outer switch blade, and means for periodically engaging and actuating the balls.

5. A switch mechanism comprising in combination a supporting member, an outer contact spring blade carried by said member and spaced from a face thereof and having a free end, an inner spring blade carried by said member and having a free end overlapping the free end of the outer blade, said supporting member having a hole therethrough and a ball loosely carried in said hole, and means to force the ball against said under blade including a rotor having a ball moving portion presenting a centering seat toward said ball to engage the same and hold it in blade actuating position.

6. In a switch mechanism, in combination, a supporting disc, an outer contact assembly carried by the disc and spaced from a face thereof, the assembly including a body portion secured to the disc along its periphery and a plurality of flexible switch blades extending inwardly therefrom and terminating on a common circle, a plurality of under contact assemblies each related to but normally spaced from a switch blade of the outer assembly, the under assemblies each including a base portion secured to the disc adjacent its periphery and a flexible switch blade extending inwardly therefrom and terminating on the comomn circle whereby the ends thereof underlie the ends of the switch blades of the outer assembly, the disc being provided with a series of apertures arranged on the common circle, each of which registers with a set of under and outer switch blade ends, means operatively disposed in said apertures for actuating the ends of the blades of the under assemblies into engagement with the overlying ends of the blades of the outer assembly, and periodically operating means for actuating in serial manner said last-named means.

7. In a switch mechanism, in combination, a supporting disc, an outer contact assembly carried by the member and spaced from a face thereof, the assembly including a body portion secured to the disc along its periphery and a plurality of flexible switch blades extending inwardly therefrom and terminating on a common circle, a plurality of under contact assemblies each related to but normally spaced from a switch blade of the outer assembly, the under assemblies each including a base portion secured to the disc adjacent its periphery and a flexible switch blade extending inwardly therefrom and terminating on the common circle whereby the ends thereof underlie the ends of the switch blades of the outer assembly, the disc having a series of apertures arranged on the common circle, each registering with a related pair of under and outer blade ends, a ball loosely carried in each of said apertures and adapted upon actuation to move the end of an under switch blade into engagement with the end of an outer switch blade, and periodically operating means for actuating the balls in serial manner.

8. A switch mechanism comprising, in combination, a supporting member, an outer contact spring blade carried by the member, spaced from a face thereof and having a free end, an inner spring blade carried by said member and having a free end overlying the free end of the outer blade, said member having a hole therethrough and a ball loosely carried in said hole, a rotor, and a dished head mounted on said rotor, said rotor being rotatable to move the head thereof into engagement with said ball to force the same against the under side of the free end of the under blade to move the under blade into contact with the outer blade, the dished portion of said head acting to center the ball on the head.

9. Switch mechanism comprising in combination opposed spaced contact blades one of which has a contact portion yieldingly movable toward a contact portion of the other, a rotor, a support for a ball, a ball loosely retained by said support between and in rolling contact with a portion of one of said blades and a portion of said rotor, and means on the rotor for imparting blade actuating movement to the ball.

10. Switch mechanism comprising in combination opposed spaced contact blades, one of which has a contact portion yieldingly movable toward a contact portion of the other, a rotor, a blade pushing element loosely supported between said yieldingly movable contact portion of one of said blades and said rotor, and a camming element on the rotor for engaging and actuating said blade pushing element, one of said elements having a centering seat for engagement with the other of said elements.

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CERTIFICATE OF CORRECTION.

Patent No. 2,184,611. December 26, 1939.

LEONARD C. COBBETT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, lines 6 and 57, claims 1 and 3 respectively, for the word "circuit" read circle; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of April, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.