July 11, 1950 H. A. COWARDIN 2,515,078

SWITCH DEVICE

Filed July 3, 1946

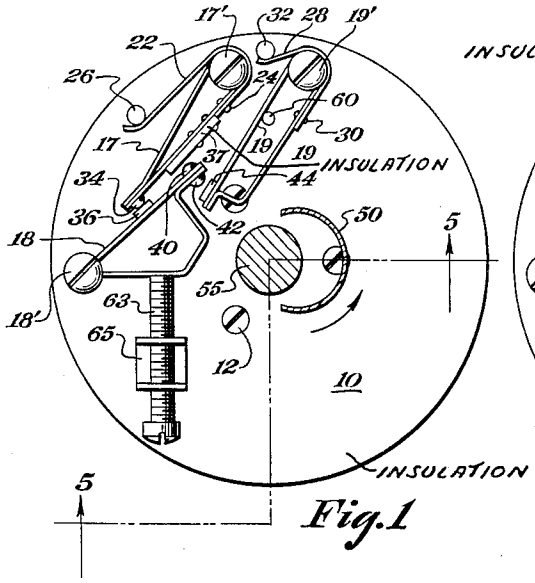


Fig.1

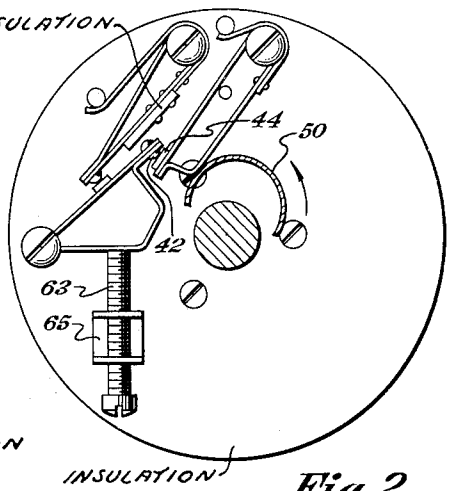


Fig.2

Fig.5

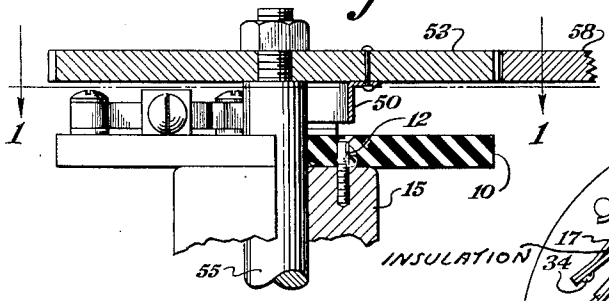


Fig.4

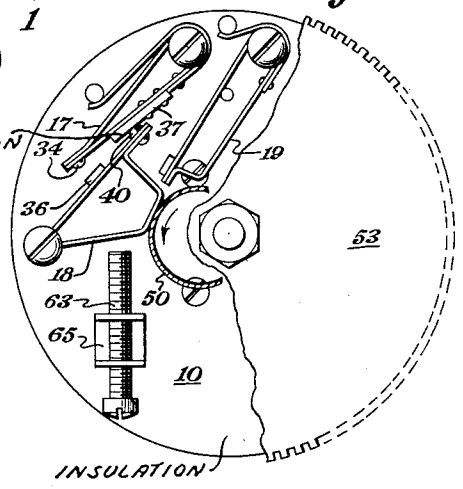
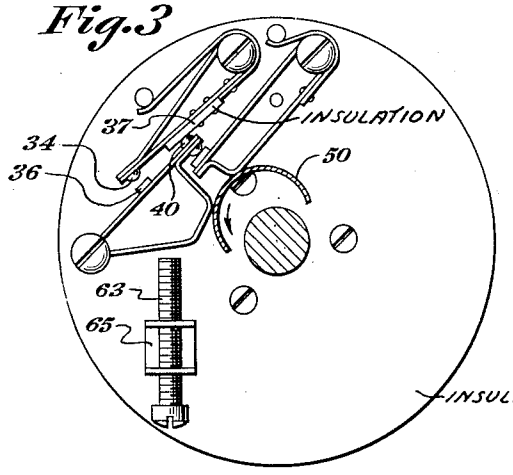


Fig.3



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Patented July 11, 1950

2,515,078

UNITED STATES PATENT OFFICE

2,515,078

SWITCH DEVICE

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Application July 3, 1946, Serial No. 681,173

6 Claims. (Cl. 200—27)

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This invention relates to switch mechanisms and more particularly to switch mechanisms for providing periodic contact of predeterminable intervals.

To the best of my knowledge, prior attempts to construct switches of the class described have fallen short of complete success for a number of reasons. In the case of mechanisms which use wipe contacts the arcing and burning of the contact members soon affect the duration of contact. Further, the stationary contact members in such type of switch have a tendency to bounce which produces a series of short contacts rather than a single contact of definite duration. In switches of the cam operated type, the contact members are particularly susceptible to bouncing and in such cases where one of the contact members is spring accelerated, failure to accelerate rapidly enough will cause a variation in time of contact interruptions of the contact.

Accordingly it is an object of my invention to provide a switch mechanism of the class described which eliminates the difficulties hereinabove set forth.

It is a further object of my invention to provide a mechanism having a minimum of moving members and which readily lends itself for manufacture by mass production methods.

In achieving the above objects, I provide a switch structure wherein the duration of contact is adjustably determined by varying the length of travel between a pair of periodically abutting members. Further, my contact members are so devised as to be held together at the point of contact by a force equal to the sum of the pressure of a plurality of springs associated with said members and adapted to bias respective members to a position of rest. This holding force is augmented by inertia forces developed in accelerating the contact members. My structure is such as to provide smooth operation with, however, abrupt interruption of contact.

My invention will now be described in detail in conjunction with the accompanying drawings in which:

Figures 1 through 4 illustrate progressive positions of the elements of my mechanism during a complete cycle of operation, Figure 1 being a section through 1—1 of Figure 5; and Figure 5 being a section through 5—5 of Figure 1.

With reference to the drawings, my invention comprises a supporting plate 10 of any suitable insulating material and which is secured by bolts 12 to a stationary post 15, or other stationary member associated with the particular equipment

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used in conjunction with my device. Arms 17, 18 and 19 are supported on plate 10 and secured thereto by suitable bolts 17', 18' and 19', respectively, the construction and arrangement being such that the three arms which are formed of bent metal strips substantially as shown, are pivotally related to plate 10 and to each other. Arm 17 is biased towards arm 18 by means of a leaf spring 22 wrapped about a portion of the surface of arm 17 and secured thereto as by a rivet 24. The free end of spring 22 abuts a fixed post 26 secured to plate 10. Accordingly, it will be understood that arm 17 is resiliently biased towards arm 18. Arm 19 is provided with a spring 28 similarly secured thereto as by a rivet 30 and the free end of spring 28 abuts a fixed post 32 secured to plate 10. Accordingly, it will be understood that arm 19 is resiliently biased away from arm 18. Arm 17 carries a contact point 34 adapted to normally engage a contact point 36 on arm 18 due to the bias of spring 22. Arm 17 also carries an abutment means comprising a member 37 of any suitable insulating material. Arm 18 carries an abutment means 40 normally spaced from member 37. Abutment means 40 may comprise a metallic rivet having the dual function of securing arm 18 in the desired shape and also affording a contact point 42 on the underside of arm 18. Arm 19 carries a contact point 44 normally spaced from contact point 42 by virtue of the biasing action of spring 28.

A cam member 50 is secured eccentrically to a gear 53 (Figure 5), which is mounted concentrically with plate 10 on a rotary shaft 55, cam 50 being arranged to rotate with gear 53 relative to plate 10 so as to engage arm 19 as shown in Figures 2 and 3. With reference to Figure 5, a portion of a driving gear 58 is shown which may be assumed to be part of the mechanism with which my device is associated, and it will be understood that rotation of gear 58 at a uniform speed imparts by virtue of gear 53 and cam 50, a uniform periodic oscillation to arm 19, the extent of return travel of arm 19 being determined by a fixed post 60 secured to plate 10.

The electrical switch of the present invention is intended to control an electrical circuit which includes bolts 17' and 19'. It will be appreciated that rotation of cam 50 causes initial engagement between points 42 and 44, whereupon current can flow between bolts 17' and 19' by virtue of engaged contact points 34 and 36. This condition is shown in Fig. 2. Continued rotation of cam 50, as shown in Figure 3, causes engagement of abutment means 40 with 37, which serves to in-

terrupt the contact between points 34 and 36 by virtue of the difference in angular velocities of the overlapped portions of arms 17 and 18 whence current between bolts 17' and 19' ceases. Further rotation of cam 50, as shown in Figure 4, further increases the gap between contact points 34 and 36 until cam 50 passes from engagement with arm 19 and engages arm 18. Arm 19 then snaps back to the position shown in Figure 1, and ultimately cam 50 passes from engagement with arm 18 whence arms 17 and 18 assume the positions shown therefore in Figure 1.

It will be clear from the drawings and specification that the switch device of this invention is capable of controlling a circuit between the posts 17' and 18' and a separate circuit between the posts 18' and 19' in the event it is desired to operate the device as a single pole double throw switch.

Also it will be readily apparent that if desired the device may be used as a circuit breaker for a circuit between the bolts 17' and 19'. In the latter event the closing of the circuit is effected by the contacts 42 and 44 while the opening of the circuit is effected by the disengagement of contacts 34 and 36 as will be hereinafter described. When the cam 50 rotates in the direction of the arrow, the lower end of the arm 19 will be moved to the left as viewed in Figure 1, so that contacts 42 and 44 are engaged to close the circuit. The circuit from bolt 17' to bolt 19' will remain closed during the time the cam 50 continues to move the lower end of the arm 19 to the left which thereby moves the arm 18 counter-clockwise until the abutment 40 engages the insulating abutment 37 on the arm 17. As will be seen from the drawings, by virtue of the fact that the arms 17 and 18 are respectively pivoted about spaced points and by virtue of the fact that there are portions of these arms which overlap, there will be a difference in the angular velocities of the contacts 34 and 36 so that they will be disengaged as soon as the abutment 40 engages the abutment 37, thus breaking the circuit between posts 17' and 19'. As the cam 50 continues to rotate in the direction of the arrow, it will engage the underside of the arm 18 and hold the latter in a fixed position against the action of the spring 22 which resiliently biases the arm 17 against the arm 18, and from an inspection of the drawings it will be noted that the cam 50 will be disengaged from the lower side of the arm 19 before it is disengaged from the lower side of the arm 18. This permits the arm 19 to snap back to its normal position of rest while the arm 18 temporarily continues to be engaged by the cam, thus causing the contacts 42 and 44 to open. A continued operation of the cam in the direction of the arrow disengages the cam from the lower side of the arm 18 which then returns to its normal position of rest under the action of the spring 22. Thus it will be seen that the circuit between posts 17' and 19' is closed by virtue of engagement of contacts 42 and 44 and the same circuit is opened by virtue of disengagement of the contacts 34 and 36 and because of the subsequent sequential operation of snap-back action of arms 19 and 18 the contacts 42 and 44 are opened before contacts 34 and 36 are subsequently closed. This insures that a circuit is broken only at the points 34 and 36. As will be clearly understood, the greater amount of burning, wearing and deterioration of electrical contacts occurs upon the opening of an electrical circuit rather than upon the closing of the circuit. To this end, a salient feature of this invention resides in the arrangement of the operation of the contacts 34 and 36 to compensate for the wear of these contacts. It will be seen that since the contacts 34 and 36 will decrease in thickness due to wear and burning, the abutment members 37 and 40 will likewise decrease in thickness due to wear. By suitable choice of material for these contact points and the abutment members 37 and 40, it is contemplated that the effect of the decrease in thickness of the contact points 34 and 36 will be compensated for by the decrease in thickness of the abutment members 37 and 40. Referring specifically to Figure 1, it will be noted that should the contact points 34 and 36 decrease in thickness, the abutment members 37 and 40 will decrease in substantial proportion and it will take substantially the same amount of movement of arm 18 to disengage the contacts 34 and 36. In other words, the wear between the contact points will be substantially neutralized by the wear between the abutment members so that the net effect will be that the duration of intermittent electrical contact will remain substantially constant over long periods of operation.

It will be readily apparent that the present mechanism is adapted to precision operation and its purpose is to provide a cam operated circuit making and breaking device in which the duration of the closing of the circuit is sensibly constant over long periods of time. The variation in a cam operated device is caused primarily by the very small change in the thickness of the contacts and other wearing parts such as the cam. The manner in which the wear and deterioration of the contact points is compensated for has just been described. However, in order to provide a vernier adjustment of the instant at which the circuit is closed, means is provided for varying the width of the gap between contacts 42 and 44 when all of the contact arms are in their normal position of rest and with the cam 50 disengaged from either the arm 19 or the arm 18. To this end the clockwise pivotal movement of the arm 18 is limited by suitable stop means in the form of a threaded adjusting screw 63 suitably mounted on a bracket 65 fixed to the plate 10. By adjustment of screw 63 the opening of the gap between the contacts 42 and 44 may be varied to predetermine the distance the arm 19 must travel before the contacts 42 and 44 are engaged to close the circuit.

I believe my invention capable of considerable modification without departing from the spirit thereof, and accordingly I do not consider myself bound by the specific illustration hereinabove described except as set forth in the appended claims.

Having thus described my invention, what I claim is:

1. In a device of the class described, a pair of arms, conductive contact points on said arms, said contact points being normally engaged, abutment means on respective arms, said abutment means being normally spaced, said arms being pivotally related to each other to effect engagement between said abutment means, spring means for resiliently biasing one of said arms towards the other, manually adjustable means operable on said other arm for predetermining the length of travel between said abutment means, one of said abutment means comprising a non-conductive member, and means for causing periodic engagement of said abutment means comprising a third arm pivotally related to said other arm and

resiliently biased therefrom and including a cam for causing periodic oscillation of said third arm whereby said third arm is operative to periodically engage and oscillate said other arm.

2. In a device of the class described, a first arm, a second arm and a third arm, said arms being pivotally related with respect to each other, said second arm being intermediate said first arm and said third arm, said first arm being resiliently biased towards said second arm, said third arm being resiliently biased away from said second arm, normally engaged contact points between said first and second arms, normally spaced abutment means between said first and second arms, normally spaced contact points between the second and third arms, and means for periodically oscillating said third arm to cause engagement between said contact points of said second and third arms, said engagement being operative to periodically oscillate said second arm to cause engagement between said abutment means of said first and second arms whereby engagement of said contact points of said first and second arms is periodically interrupted in response to oscillation of said first arm.

3. In a device as set forth in claim 2, wherein said three arms are comprised of conductive material and wherein one of said abutment means between said first and second arms comprises a non-conductive member.

4. In a device as set forth in claim 2, including manually adjustable means operable upon said second arm to predetermine the length of travel of the abutment means thereon towards the abutment means on said first arm.

5. In a device of the class described, a first contact arm, a second contact arm and a third contact arm, each of said arms having electrical contact elements, said first and second contact arms having portions in overlapped relation and being mounted for pivotal movement in opposite directions about spaced points, said second arm being intermediate said first and third arms, each of said first and second arms having an abutment on the respective overlapped portions of said arms, one of said abutments being an insulating member, said abutments being adapted to be brought into non-conductive engagement, said third arm having a contact point for electrical engagement with said second arm, adjustable

stop means for limiting the pivotal movement of said second arm, means for biasing said first arm for pivotal movement in a direction to cause engagement of said contact elements on said first and second arms, and means for causing said third arm to pivot against said second arm whereby simultaneous pivotal movement of said first and second arms about their respective pivot points will cause a difference in angular velocity of said overlapped portions of said first and second arms and will cause engagement between said abutments and disengagement of said contacts carried by said arms.

6. In a device of the class described, a pair of contact arms, each having portions arranged in overlapped relation, each of said arms having a contact point adapted for engagement with the other contact point, each of said arms also having an abutment adapted for engagement with the other abutment, said arms being mounted for pivotal movement about spaced points, a third contact arm also mounted for pivotal movement and having a contact point adapted to be brought into conductive engagement with one of said first mentioned pair of contact arms and means for causing said third contact arm to be moved toward one of said pair of contact arms and to cause pivotal movement of the latter against the other of said pair of contact arms, whereby simultaneous pivotal movement of said pair of arms about their respective pivot points will cause a difference in angular velocity of said overlapped portions of said pair of arms and will cause engagement between said abutments and disengagement of said contacts carried by said pair of arms.

HARRY A. COWARDIN.

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