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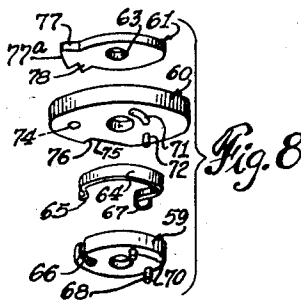
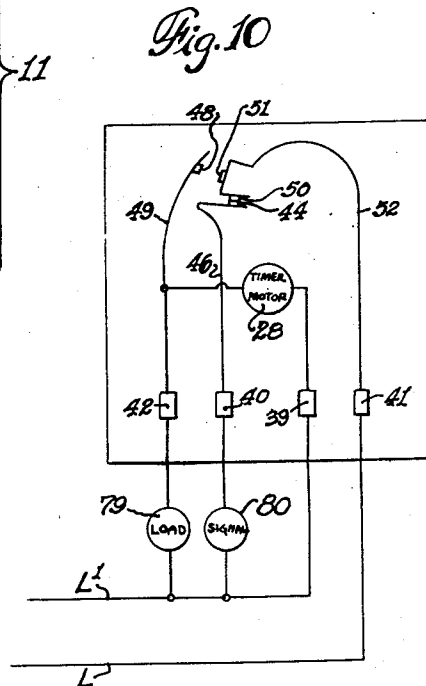
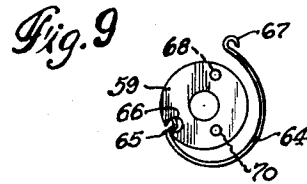
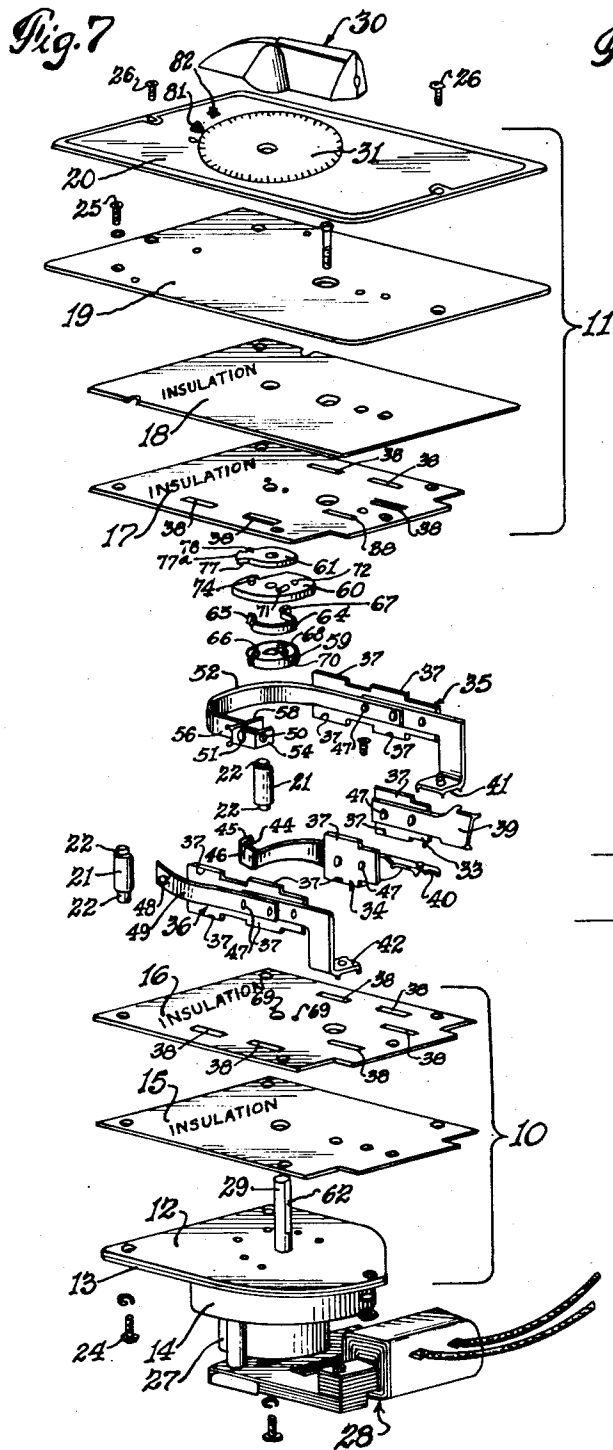
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# TIME-CONTROLLED ELECTRIC SWITCH

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## TIME-CONTROLLED ELECTRIC SWITCH

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1

The present invention relates to that type of electric switch wherein the movable contact or contacts are carried on a curved spring arm that is constantly under stress, the curvature and stressing being varied by a rotary actuator in a manner to cause the switch to open and close with a snap action. The object of the present invention is to produce a superior switch of this type.

One of the better switches of the aforesaid type now in use has an actuator cam in the form of a notched disc on the edge of which the spring arm rides. It may take only a small angular movement of the disc to effect an opening or closing of the switch, although a much greater angular movement may be needed to provide the time element in the event that the opening (or closing) period is determined by a motor driven timing device. In such case the switch arm acts as a brake during the entire "timing out" period, thereby making it necessary to use a more powerful motor than would otherwise be necessary.

Viewed in one of its aspects, the object of the present invention is to eliminate the greater part of the aforesaid braking action and thus permit the use of a smaller motor than would be needed in a conventional time switch.

Viewed in another of its aspects, the present invention may be said to have for its object to produce a form of actuator that places on the timing motor no other load than that needed to rotate a finger piece or the like except for a very short time which is constant regardless of the length of the timing period.

A further object of the present invention is to secure a snap action that is quicker, sharper and less affected by ordinary wear than is possible with conventional switches of the type under consideration.

In prior devices the spring arm which carries the movable contact is bent to create a lateral projection inwardly from the contact; this projection riding on the edge of the actuating disc and into and out of a notch in the latter to open and close the switch. The bend cannot be made sufficiently sharp, nor is the material best suited for use in the spring arm of the proper kind to secure the desirable quick snap action, initially and after wear takes place.

One of the objects of the present invention is to produce a novel spring arm unit wherein the projection, which cooperates with the camming devices, shall be a separate piece composed of a material and of a shape best suited to carry out its intended purpose.

A still further object of the present invention is to provide means to ensure that a movable contact will always engage the cooperating contact and be positively held in engagement therewith, in the same manner, regardless of wear or of

2

slightly variations in the curvature or stressing of the spring arm on which it is carried.

In addition to a main circuit to be controlled, it is often desirable that an auxiliary circuit, such as a signal circuit for example, be modified at the same time as the main circuit. A further object of the present invention is to provide my improved basic switch, in a simple and novel manner, with auxiliary contacts for controlling a circuit in addition to that controlled by the main contacts.

Where the switch has two pairs of contacts, those of one pair should usually be in engagement with each other while the others are separated. A still further object of the present invention is so to construct my improved switch that when it has two pairs of contacts, it may be adjusted to cause the contacts of both pairs to become separated at the same time.

The various features of novelty whereby the present invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of the invention and its objects and advantages, including those that have already been mentioned and others, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a side view of a switch device in which the present invention is embodied in a preferred form; Figs. 2, 3 and 4 are like top plan views of the device with the top plates and finger piece removed, illustrating, respectively, the main switch open and the auxiliary switch closed, both switches open, and the main switch closed and auxiliary switch open; Fig. 5 is a view, on a larger scale than Figs. 2, 3 and 4, showing fragments of the actuator and of the spring arm that carries the main movable contact, showing the condition which exists at the instant when the arm is ready to snap into its "timed out" position; Fig. 6 is a section, on a larger scale, on line 6—6 of Fig. 4; Fig. 7 is an exploded view of the device, showing the various parts in perspective and spaced apart from each other in the vertical direction; Fig. 8 is a view similar to Fig. 7, but on a larger scale and making visible the under side of the elements, instead of the upper sides, and only the parts of the actuator and its immediate support being shown; Fig. 9 is a top plan view of the spacer that forms the immediate support for the two part actuator, together with the spring that connects the spacer to the lower part of the actuator; and Fig. 10 is a circuit diagram of connections.

In the drawing there is illustrated what is believed to be a preferred commercial form of the invention, and, for the sake of brevity, the detailed description will be confined to this particular embodiment to explain the principle of the

invention, although many of the structural details so illustrated may be varied and even omitted.

The parts of the switch means proper are shown more clearly in Fig. 1 as interposed between parallel lower and upper laminated floor and ceiling panels, 10 and 11, respectively. The floor panel is composed of a metal plate 12 resting on a flange 13 at the top of a housing 14 to be referred to later. Lying upon plate 12 is a thin plate 15 of insulating material and on this plate rests another plate 16, thicker than plate 15, also of insulating material. The upper panel is composed of a bottom plate 17 that may be a duplicate of plate 16; a plate 18 similar to plate 15; a metal plate 19; and a dial plate 20 that constitutes the top ply. Corner posts 21, having short sections 22 of reduced diameter at their upper and lower ends, are interposed between the upper and lower panels; the reduced neck portions of the posts entering suitable holes in the plates of the corresponding panels and the body portions of the same constituting spacers between the panels. The bottom panel is fastened to the post by screws 24. Plates 17, 18 and 19 of the upper panel are fastened to the posts by screws 25, similar to screws 24. The upper ends of the posts do not pass through the dial plate which is fastened to plate 19 by little screws 26.

Housing 14 is on top of a casing 27 for the rotor of a synchronous timing motor 28 and contains speed reducing gearing and a suitable clutch, usually a friction clutch, to connect the rotor to a vertical shaft 29 extending up through the bottom panel, through the space between the panels and through and beyond the upper panel. These mechanisms are in common use and the details thereof do not need to be illustrated. On the upper end of shaft 29 is a combined finger piece and pointer 30, arranged close to the dial plate and cooperating with a graduated dial 31 on the latter.

Shaft 29 can be turned in one direction by the finger piece through any desired angle, the size of which is indicated on the dial, and is then returned to the normal or starting point by the motor; the time factor being determined by said angle and the speed at which the motor drives shaft 29. The presence of a friction clutch between the gear train and the shaft permits the shaft to be turned by the finger piece without turning the rotor member of the motor; the shaft, therefore, being turnable in both directions by the finger piece.

The present invention resides in the switch mechanism disposed in the space between the two panels 10 and 11, which mechanism will now be described.

Clamped between the panels are four stiff strips of insulating material as wide as the distance between the panels, and set on edge; the strips being parallel and symmetrically disposed with respect to the shaft 29. There are two short strips 33 and 34, and two long strips 35 and 36, all extending inwardly from the same edge or side of the structure. One short strip and one long strip lie on each side of a center line which intersects the axis of the shaft; the short strips being positioned between and spaced apart from the long strips. The long strips preferably extend inwardly past shaft 29. All of the strips are provided at their upper and lower edges with ears 37 that fit into slots 38 cut into base plates 16 and 17, respectively; the strips being thus immovably held in place. Each strip has at its outer end a metal terminal, these being numbered 39, 40,

41 and 42, respectively. One of the terminals, terminal 41, is adapted to be connected to a line wire L from a source of current and the other three to a wire L' from said source.

Strips 34 and 36, on the same side of the center line, support the so-called stationary contacts of a pair of switches. Stationary contact 44 for the auxiliary switch is mounted on a laterally bent end, flange or lip 45 on a long curved spring arm 46, preferably of the leaf type, fastened to the terminal 40; the same fastenings 47 conveniently securing these two elements together and to strip 34. Spring arm 46 curves laterally toward strip 36 and comes in contact with the side thereof at a short distance from the inner end of the strip; there being a sharp angled bend in the arm near the flange or lip to provide a short, practically straight section 46<sup>a</sup> to which further reference will be made. Stationary contact 48 for the main switch is carried on the inner side of a slightly curved spring arm 49 lying on the outer side of strip 36; being fastened to terminal 42 and long enough to project beyond the inner end of strip 36. Normally, when unconstrained, contact 48 lies a little beyond the end of strip 36, reaching to about the plane of the inner face of the strip, as shown in Fig. 2.

The movable contacts 50 and 51, that cooperate with the stationary contacts 44 and 48, respectively, are carried on a long J-shaped spring arm 52, the hook part of which is roughly a semicircle. Arm 52 is preferably of the leaf type, its straight stem portion being fastened to terminal 41 and extending along the inner side of strip 35 and then curving over into proximity to the inner end of strip 36. Contact piece 50 is on an intumed flange or lip 54 at the extreme end. The parts are so proportioned that when free to do so the arm takes such shape as to cause contact 50 to bear against auxiliary contact 44, with lips or flanges 54 and 45 approximately parallel to each other. Contact 51 is mounted on the outer side of the cross piece 55 of a U-shaped outward bend or protuberance at the free end of arm 52; lip or flange 54 forming one leg of the U and 56 being the other leg. The bends in this protuberance are sharp as is the bend between the latter and the adjacent portion of the spring arm. Within the U is a thick, stiff plate 57 lying flat against and fastened to cross piece 55, this plate extending from leg to leg of the U. At the end of plate 57, adjacent to leg 56, is an extension 58 that starts in the angle between elements 55 and 56 and inclines away from element 56 so as to be almost radial to the axis of shaft 29. Part 58, which may be termed "lifter plate," is about twice as long as leg 56 of the U and has a square cut vertical edge that lies well out beyond the open end of the U.

Surrounding the shaft 29 are three thick, flat pieces of insulating material 59, 60 and 61, which are conveniently discs; piece 59 being of small diameter, loose on the shaft, and resting on base plate 16; piece 60 being a larger disc resting on disc 59; and piece 61 being another small disc that rests on piece 60. Disc 61 is held to the shaft so that it must turn therewith, conveniently by providing the shaft 29 with a flat zone 62 on one side and shaping the hole 63 in the disc so that the flattened part of the shaft fits in the same. Disc 59 is simply a spacer which serves also as an anchor for a C spring 64 of leaf material. This spring partially surrounds disc 59 and has a bent end 65 hooked into a pocket 66 in the edge of that disc in such a manner that

5

the spring stands clear of the edge of the disc for substantially its whole length. The free outer end of spring 65 is bent into the form of a partially closed, vertical tube 67. The spacer disc 59 is held against rotation by means of pins 68 and 70, extending downwardly below the lower face, and these pins enter holes 69 in base plate 16. Rising from the top of disc 59, the pin 70 extends into an arcuate slot 71 in disc 60; the pin 68 extending only below the disc 59 and not above its upper face. This slot 71 is short and is concentric with disc 60. Disc 60 carries a pin 72 that extends only below the lower face of disc 60 into the tubular part 67 at one end of the spring 64. Projecting only above the upper face of disc 60 is a pin 74 that lies outwardly beyond the periphery of disc 61. Disc 60 has a long notch 75 cut into the edge near pin 74. The notch 75 is deepest at the end nearest the pin 74 and its opposite end, which constitutes a cam surface, slopes to a vanishing point at the periphery. The shoulder 76 at the deep end of the notch, is substantially radial, providing an abrupt drop to the cam surface. Disc 61 has a narrow radial lug 77 extending from the periphery of the disc 60 for engagement with pin 74 in one relative angular position of discs 60 and 61. This lug is abruptly widened toward the base, on the side away from pin 74, to produce a step 78. The angular width of the base portion of lug 77 should not be greater than the angular distance through which pin 70 and slot 71 permit disc 60, which may be called the "following cam," to turn. This permits disc 61, the "moving cam," to turn through an angular distance of at least 360°.

Spring 64 tends constantly to stand clear of the disc 59 except at its anchoring point thereon, as in Fig. 8. The parts are so proportioned that when disc 60 is brought into the angular position which it occupies in Fig. 2, spring 64 is wrapped more closely around disc 59 and is placed under increased tension. This increased tension is sufficient to turn disc 60 in the clockwise direction, as viewed in Fig. 2, until pin 70 is at the opposite end of arcuate slot 71, when the disc is left otherwise unrestrained. The disc 60 is brought into the position that it has in Fig. 2 by turning shaft 29 and, therefore disc 61, in the counterclockwise direction. The shaft may be turned in either direction by means of the finger piece 30, or in the counterclockwise direction by the motor. In any event, whenever disc 61 turns in the counterclockwise direction until lug 77 strikes pin 74 on disc 60, a continued movement of disc 61 carries disc 60 along with it until both discs are stopped in their Fig. 2 positions.

When the discs are in the positions shown in Fig. 2, auxiliary contacts 44 and 50 engage with each other and the meeting ends of spring arms 46 and 52 bear against the inner face of stationary strip 36 near the inner end of the latter. It will be seen that at this time the bend between the main part of arm 46 and the short straight section 46<sup>a</sup>, which stands at a considerable angle to the plane of strip 36 when the arm is unconstrained, as in Figs. 3 and 4, becomes more acute so that part 46<sup>a</sup> may even lie flat against the strip. This characteristic permits contact 44 to yield sufficiently to make a good connection. The sharp, free vertical edge of the stiff plate 58 on spring arm 52 at this time rests on the edge of disc 60 at an intermediate point in the long cam notch 75; and the broad side of the plate or blade bears against the edge

6

of lug 77 that is on the side opposite to pin 74. Although spring arm 52 is under stress, contact 51 is held clear of cooperating contact 48 because the free end of this arm is trapped behind, namely on the inner side of, stationary strip 36.

The situation is now as indicated in the diagram, Fig. 10, the circuit through the motor 28 and through the load 79 being interrupted and the circuit that is controlled by the auxiliary contacts which may, for example, be a signal 80, being closed. The signal calls attention to the fact that the main circuits are open. Since it is a waste of energy to keep the signal energized when the timing apparatus is to remain idle for a long period of time, the parts are so proportioned that the auxiliary contacts can be separated from each other without closing the main switch. Thus, as shown in Fig. 3, disc 61 can be turned through a small angle in the clockwise direction from the position which it occupies in Fig. 2, the "following cam" 60 trailing along after; thereby stressing spring arm 52 in a manner to hold contact 51 away from stationary contact 48, even though the free end of the arm has moved clear of strip 36. This results from the fact that, when "moving cam" 61 begins to turn, it exerts a leverage, through plate 58, on the U-shaped part at the free end of spring arm 52, causing it to rock in a direction to press the edge of flange or lip 54 against the edge of the "following cam", as shown in Fig. 3.

When it is desired to close the main circuits, "moving cam" is turned in the clockwise direction from the position in Fig. 2 or Fig. 3, in whichever of these positions the cam happens to be. Up to the time that the conditions illustrated in Fig. 3 are brought about, lifter plate 58 does not slide perceptibly along lug 77 but when flange or lip 54 strikes the edge of the "following cam", this plate is compelled to move outwardly along the lug that is driving it. This movement draws the free end of arm 52 in the direction of the length of strip 36 until it is carried beyond the inner end of the latter by the time that lifter plate 58 rises to the outer end of the lug. That happens before shoulder 76 in the cam notch is passed by the trailing edge of lug 77, so that the free end of the spring arm jumps laterally to bring the inner edge of plate 58 against an unutilized part of the edge of the "following cam" not far from the notch, as in Fig. 4. The only place where flange 54 can go is against the square cut inner end edge of strip 36 while contact 51 is pressed against contact 48. Thus the movable contact 51 and its immediate support are fitted into and locked in a pocket or seat, as it were, to engage the movable contact with its cooperating stationary contact; and so the switch can never fail to function properly because of ordinary wear or slight departures from the ideal in the shapes of the various elements.

The movement of contact 51 toward contact 48 is very quick and the total time consumed in snapping into place is very small because the contact, due to the novel construction of the switch, does not have to travel as far as in prior switches.

The success of the jump of lifter plate 58 upon release from lug 77 to close the main switch is made more certain by shaping the end edge 77<sup>a</sup> of lug 77 so that it is not a part of the same cylindrical surface as the unutilized portion of the edge of the "following cam". As shown in

7

Fig. 5, edge face 77<sup>a</sup> is a lower than the periphery of the "following cam" at the end nearest pin 74 in Fig. 2; and higher than such periphery at the other end. Therefore, before plate 58 is released, in the act of opening the main circuits, it is lifted a little above the cylindrical surface upon which it is to land.

If the closing of the switch is to be automatically timed, "moving disc" 61 can be turned as far as desired, through an angle of 360°, if necessary, from its original "timed out" position of Fig. 2; the following cam disc 60 standing still and there being no braking action on any moving part due to pressure thereon by any spring arm, after the "following cam" comes to rest and until lug 77 returns and picks up plate 58 again.

When main contacts 48 and 51 are brought into engagement the motor starts; so that, as soon as the operator releases the finger piece, the shaft 29 and finger piece start to turn back. Then, when lug 77<sup>a</sup> on the "moving cam" returns to engage pin 74 on the "following cam," it carries the latter back with it. Just before this happens, however, the lug rides under lifter plate 58 so as to hold it up and prevent it from dropping into the notch in the periphery of disc 60 until the trailing edge of the lug passes under the edge of the plate and allows it to snap quickly into the notch. Thus a quick break of the main circuits is ensured. As the main contacts separate, the auxiliary contacts come together and the conditions illustrated in Fig. 2 are restored.

It will be seen that because the low end of the cam surface on lug 77 is in advance as the lug approaches lifter plate 58, the lug passes under the inner or under edge of the plate without danger of striking against the side of the latter. Also, as the lug moves ahead, underneath the plate it lifts the same off the "following cam" disc to prevent a rubbing action thereon.

The dial is preferably provided with a mark 81 to indicate the point to which the pointer should be turned to change from the "timed out" condition of Fig. 2 to the "signal cutout" position of Fig. 3. Farther along the scale there is preferably a second, different mark 82 to which the finger piece should always be turned for automatic timing before setting the finger piece at the graduation in the scale corresponding to the "timing out" period desired; this being for the purpose of compensating for lost motion in the driving connection between the motor and shaft 29.

It will thus be seen that every snap action starts instantly with one sharp corner dropping off another sharp corner, this being due chiefly to the use of the stiff lifter plate instead of a V bend in the spring arm that carries the movable main contact; that the contacts of both the main and the auxiliary switches are compelled to engage each other properly in closing the circuits controlled thereby; that there is only a very slight amount of rubbing that can produce wear and add to the load on the timing motor; that the switch device can be easily set to interrupt main circuits after they have remained closed for any desired period of time over a long available range; and that the switch for a signal circuit or other auxiliary circuit opens and closes automatically as the main switch closes and opens, and may be opened or closed at will without affecting the main circuits.

While there has been illustrated and described

8

with particularity only a single preferred form of the invention, it is not desired to be limited to the exact details thus illustrated and described, but intended to cover all forms and arrangements that come within the definitions of the invention constituting the appended claims.

We claim:

1. In a switch, a base, a rotatable operating shaft rising above the base, a spring arm anchored at one end to the base remote from the shaft and curved about half way around and distant from the shaft, a contact on the arm near its free end, a cooperating stationary contact, a stiff lifter plate fixed at one edge to the arm near the free end and projecting therefrom toward the shaft, two superimposed members on the shaft extending close to said lifter plate and in planes intersecting the latter, the first being loose on and the second member being fixed to the shaft, the first member having only a small angular movement relative to the base and having a curved edge containing a notch that registers with the lifter plate in one angular position of the first member and is out of registration with said plate in another angular position of that member; the contact on the arm engaging the stationary contact when the lifter is engaged with the curved portion of the edge of the first member; a pin on the upper side of the first member, a lug on the second member extending to said edge of the first member and being of such width that it covers a part of the notch when touching the pin and a spring acting on the first member to cause it to follow the second member when the latter moves away from the pin.

2. A switch as set forth in claim 1, wherein the parts are so proportioned that, when the two members on the operating shaft are at one limit of their angular movements, the lifter plate is engaged in the notch and the lug on the second member is between and in engagement with the lifter plate and the pin on the first member.

3. A switch as set forth in claim 1, wherein at the time the switch is open, the lifter plate extends into the notch in the first member, the lug on the second member engages both the lifter plate and the pin on the first member, whereby, when the second member is turned to carry it away from the pin on the first member in a switch-closing movement, it pushes the lifter plate and flexes the arm in a manner to cause said plate to slide radially along the lug until it reaches the outer end and snaps over onto the curved edge of the first member.

4. A switch as set forth in claim 1, wherein the spring arm has its free end formed in a wide U having relatively short leg portions, the open side of the U facing inwardly, and the lifter plate being joined to the arm at the juncture of the cross piece of the U and the inner leg and standing at an acute angle to that leg.

5. A switch as set forth in claim 1, wherein the operating shaft is driven in one direction by a timing mechanism.

6. A switch as set forth in claim 1, having, in addition, a second contact on the free end of the spring arm and a second stationary contact for engagement therewith when the second member on the shaft forces the first member back as far as it will go in a "timing out" movement of the shaft.

7. A movable contact unit for a snap switch comprising a spring of J shape, a marginal portion at the free end of the sharply curved portion

forming an inwardly directed flange, and there being a contact on the convex side of the arm near said flange and a second contact on the face of the flange on the far side of the latter from the other contact.

8. A movable contact unit for a snap switch comprising a spring of J shape, the part of the spring at the free end of the sharply curved portion being deformed into a wide shallow U the open side of which faces inwardly, there being contact pieces on the outer sides of the cross piece of the U and the leg of the U at the extreme end of the arm, and a stiff lifter plate fixed to the arm at the cross piece and the inner leg of the U and extending at an angle to that leg out through the open end of the U.

9. A snap switch comprising a base, a stationary contact on the base, a rotatable shaft rising from the base, a spring arm anchored at one end to the base remote from the shaft and curved about half way around and distant from the latter, a contact on the arm near its free end for cooperation with the stationary contact, two members movable relatively to each other about the axis of the shaft, one member containing a notch; an element on said arm near the free end of the latter resting either in the notch or on the first member beside the notch, depending on the angular position of that member; a part on the second member that engages with said element and drives it toward the anchored end of the arm when the shaft is turned in one direction; and means on said second member to shift the first member when the second member turns past a predetermined point in the reverse direction.

10. A snap switch as set forth in claim 9, wherein the first member is loose on the shaft and has only a small angular movement relative to the base, the second member is fixed to the shaft, a spring is provided to move the first member in one direction, and there is a pin on the first member in position to be engaged by the second member to move the first member in the other direction.

11. In a switch, a stationary contact, a stationary stop a short distance therefrom having an end edge facing the latter and having, also, a side face; a spring arm having a contact thereon near one end and being anchored at the other end, the arm being bowed in a manner to hold its free end beside the side face on the stop, with said contacts out of engagement with each other; and an actuator engaging said arm near its free end to push it along the side face of the stop past the end edge of the latter to bring the said contacts together.

12. A switch as set forth in claim 11, wherein the actuator includes an angularly movable disc having a depression in the edge, and the arm has a projection engaged with the periphery thereof; the parts being so proportioned that said projection engages the disc in the depression at the time the arm is beside the stop and engages the edge of the disc beyond the depression while the arm rests on the end edge of the stop.

13. In a switch, a stationary contact, a stationary stop a short distance therefrom having two faces transverse to each other, a bowed spring arm in the same plane as the stationary contact and the stop and having thereon, near one end, a contact adapted to cooperate with the stationary contact, the arm being anchored at the other end; the contacts being held apart when the free end of the arm is in engagement with one face on the stop, and are engaged with each other

when the arm engages the other face of the stop; the curvature of the arm being such that the arm tends constantly to keep its free end beside one of the faces on the stop; and a movable actuator means engaged with the arm to flex it and carry its free end to a point from which it can only engage the other face of the stop.

14. In a switch, a flat base, two stiff strips of insulating material secured on edge to the base in spaced, parallel relation to each other, a spring arm fastened to one strip and extending, parallel to the base, beyond one end of that strip in sharply curved form, to the vicinity of the corresponding end of the second strip, the free end of the arm when unrestrained occupying a position wherein it overlaps the second strip on the inner side of the latter, means to shift said free end of the arm into a second position wherein it rests against the edge face at the end of the second strip, and a contact on the arm near the free end, a stationary contact so located that it engages with the other contact when the arm is in the second position and is disengaged when the arm is in its first position.

15. In a switch, a flat base, two stiff strips of insulating material secured on edge to the base in spaced, parallel relation to each other, a spring arm fastened to one strip and extending, parallel to the base, beyond one end of such strip in an arc of about 180° to bring the free end of the arm into position on the inner side of and in overlapping relation to the second strip, the free end of the arm having also a second position wherein it rests against the edge face at the end of the second strip, a contact on the arm near the free end, a stationary contact so located that it engages with the contact on the arm when the arm is in the second position and is disengaged when the arm is in its first position, and means operating on the arm when in either position and causing it to shift into the other position, a second contact on the extreme end of the said arm, and a second stationary contact so located on the inner side of the second strip as to be engaged by the second contact on the arm when said arm is in its said first position.

16. In a switch, two stiff plates of insulating material fastened together in spaced relation to each other, two stiff strips of insulating material arranged on edge between said plates in spaced, parallel relation to each other, the strips having edge projections and the plates having slots in which the projections are engaged, a spring arm fastened to one strip and extending beyond one end of the same in sharply curved form to the vicinity of the corresponding end of the second strip, the free end of the arm when unrestrained occupying a position wherein it overlaps the second strip on the inner side of the latter, said free end of the arm having a second position wherein it rests against the edge face at said end of the second strip, a contact on the free end of the arm, a leaf spring fastened on the outer side of the second strip and having a free end projecting beyond the said end of that strip, a stationary contact on the projecting end of the leaf spring in position to engage the contact on the arm when the arm is in its second position, and means to cause the arm to shift from either position into the other position.

17. In a switch, two spaced stationary contacts, a curved spring arm anchored at one end, two contacts carried at the free end of the arm in spaced relation to each other and each cooper-

ating with only one of the stationary contacts, a movable actuator composed of two relatively movable members, one of said members having surfaces that engage with and form stops for the arm in the various positions of the latter, and the second of said members having thereon a lug to engage said arm and move it away from one of said surfaces and release it at a point from which the arm can move into engagement with the other of the surfaces, said second member thus being a combined flexing and tripping device for the arm to cause either contact on the arm to engage the corresponding cooperating stationary contact while the two other contacts are spaced apart from each other.

18. A switch as set forth in claim 17, wherein the two members of the actuators move in unison with each other while the second member is traveling a predetermined distance in either direction between one extreme position of the second member and its arm tripping position, to cause engagement with each other of one pair of the cooperating contacts that are standing apart, and whereby the arm becomes so flexed at an intermediate point in such movement that the other pair of contacts also become separated.

19. In a switch, a base member, a rotatable shaft rising therefrom, a disc loose on the shaft and having a limited angular movement relative to the base, said disc having a long peripheral notch the depth of which decreases from one end to a vanishing point at the other end, a spring tending to hold said disc at one limit of its angular movements, an element on top of the disc fixed to the shaft and having a lug that extends to the periphery of the disc, a pin rising from the disc near the deep end of the notch for engagement with the lug, a stationary contact spaced apart from the disc opposite the deep end of the notch when the disc is at the second limit of its movements, a spring arm anchored on the base beyond the side of the disc opposite that on which the stationary contact is located, said arm curving sharply past and in spaced relation to the disc into the space between the latter and the stationary contact and having at its free end a flange directed toward the periphery of the disc, a rigid lifter plate of greater radial length than the flange fixed to the arm a short distance from the flange and extending more or less radially toward the periphery of the disc and in contact with the latter at the bottom of the notch when not restrained from so doing; the parts being so arranged that when the disc is in its second position and the lug bears against the pin on the disc, said lifter plate lies in front of the lug and is carried along with it when the lug moves away from the pin, the lifter plate at the same time sliding radially along the lug until it reaches the outer end of the latter, the movement of the lifter plate causing the spring arm to be cramped until the flange thereon abuts against the edge of the disc and stores up energy sufficient to permit the moving contact to snap into engagement with the stationary contact upon the release of the lifter plate from the lug.

20. In a switch, a base, a rotatable shaft rising from the base, a disc loose on the shaft and mounted on the base for small angular movements from one of two predetermined positions to the other, a spring yieldingly holding the disc in the first of said positions, said disc having in its edge a notch, a member fixed to the shaft and overlying the disc, a stop on the disc in the path

of said member to permit said member to drive the disc from the first to the second position when said member is turned in one direction, said member having a part extending to the periphery of the disc and of such width that it partly overlaps the notch when said member is engaged with said stop, a stressed spring arm in the plane of the disc anchored at one end to the base and curved at its free end past said notch, an element on the arm near the free end extending into that part of the notch left uncovered by said member at the time the latter is holding the disc in its second position, the free end of the arm being sufficiently wide to lie in the path of movement of said member, a stationary contact on the base, and a contact on said arm for cooperation with the stationary contact.

21. A switch as set forth in claim 20, wherein the contacts are so disposed that they engage with each other when the disc is in its first position.

22. A switch as set forth in claim 20, wherein the contacts are so disposed that they engage with each other when the disc is in its second position.

23. A switch as set forth in claim 20, including a second stationary contact and a second contact on the spring arm, the latter contacts being so disposed that they engage with each other only when the other two contacts stand apart from each other.

24. A snap switch comprising a base, a stationary contact on the base, a rotatable shaft rising from the base, a spring arm anchored at one end to the base remote from the latter, a contact on the arm near its free end for cooperation with the stationary contact; two members on the shaft adjacent to each other, the first member being loose on and the second member being fixed to the shaft, and the first member containing a peripheral notch; a stop to limit the turning movements of said members in one direction; an element on said arm near its free end that drops into said notch when the first member is at the limit determined by the aforesaid stop; a part on the second member in position to engage said element at the time that both members are arrested by the aforesaid stop and drive that element toward the anchored end of the arm, thereby altering the curvature of the arm sufficiently to lift the said element out of said notch when the shaft is turned in one direction and, on the recoil of the arm, to come to rest on the first member away from the notch; a spring tending constantly to turn said first member to the position in which said element leaves the notch; a second stop to arrest the turning movement of said first member when it reaches said last-mentioned position; and means on the second member to engage the first member, when the shaft is turned in the opposite direction, and shift it from the second stop to the first stop.

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