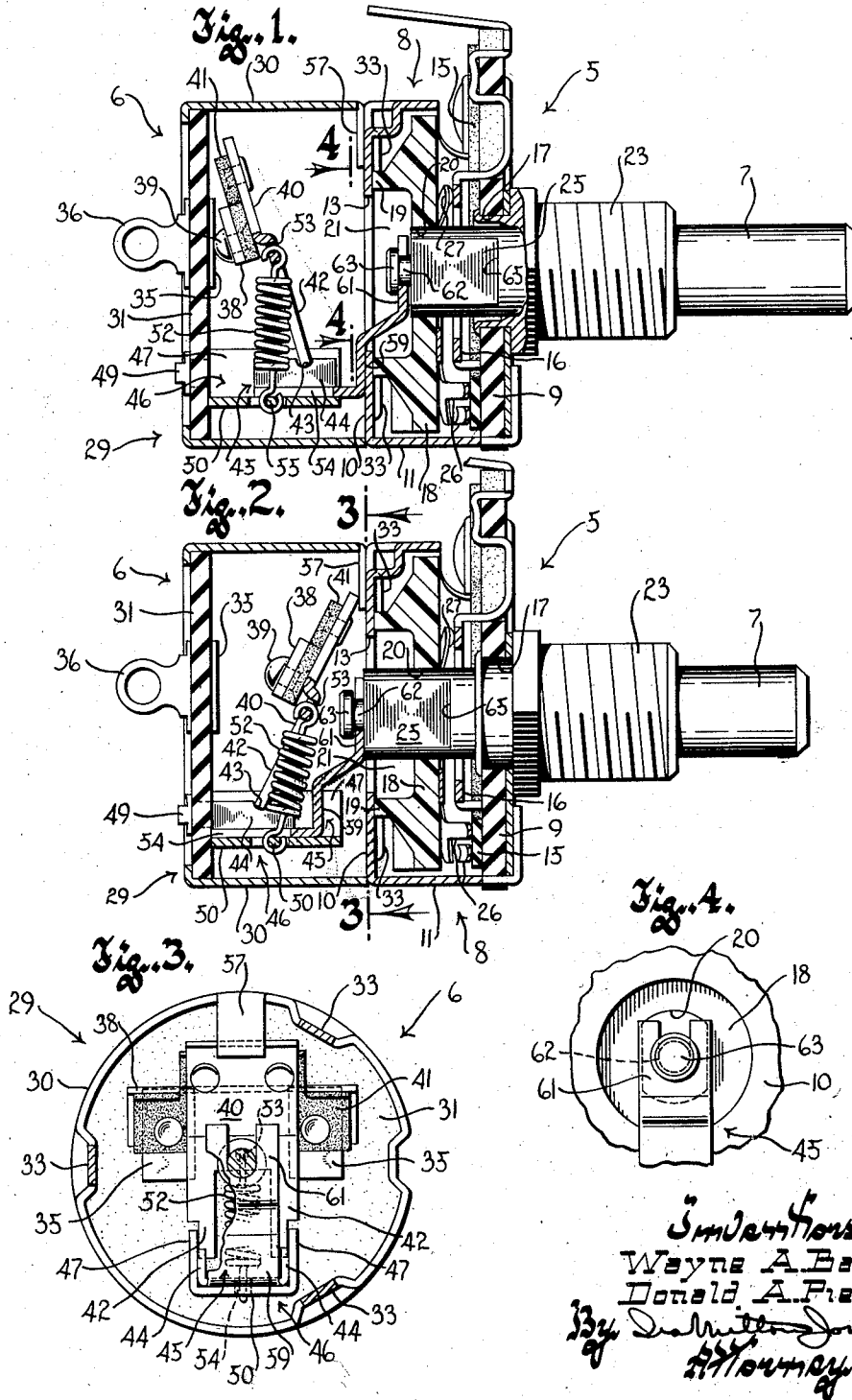


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AND VARIABLE RESISTOR
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COMBINATION SNAP ACTION PUSH-PULL SWITCH AND VARIABLE RESISTOR

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3 Claims. (Cl. 290—67)

This invention relates to electrical control instrumentalities and has more particular reference to a tandem mounted combination variable resistor and electric switch of the type suitable for use in radio and television receivers. In general, it is the purpose of this invention to provide a combination electrical control instrumentality of this type wherein the switch may be operated without disturbing the setting of the variable resistor.

In the conventional combination on-off switch and volume control used on radio and television receivers, rotation of a common drive shaft for the unit effects actuation of both the switch and the variable resistor. Hence, with this conventional arrangement, the switch cannot be actuated to the off position without adjusting the volume to its lowest setting, and each time the receiver is turned on the operator must patiently wait through a rather lengthy warm-up period before the volume can be re-adjusted to the desired level.

In the past some effort has been made to correct this undesirable situation through the provision of a combination switch and variable resistor wherein rotation of a single operating shaft effected adjustment of the variable resistor and axial motion of the shaft effected switch actuation without disturbing the setting of the variable resistor. However, the switch components of such switch and variable resistor combinations have not only lacked the positive snap action desired in electric switches, but they have been excessively space consuming and bulky because they merely combined a variable resistor with a conventional rotary type switch having its parts reoriented so that the switch arm moved edgewise in a plane parallel to the axis of the common actuating shaft of the combination. This reorientation was one of the first and most obvious solutions to the problem of push-pull switch operation in a combination unit of the character described.

As the radio and television industry has progressed, however, many economies have been effected. Significant among these economies has been the use of smaller, lighter and more compact parts and assemblies to conserve the amount of metal and other materials required. This progress has made possible the mass production of small, compact, light weight and reasonably priced table model radios of good quality. The combination variable resistor and conventional reoriented push-pull switch of large and bulky proportions obviously was unsuitable for such small and compact table model radios. Moreover, the conventional switch components of such combination units, reoriented for push-pull operation, required a considerable amount of force for their actuation, with the result that small radios in which they were installed were frequently moved bodily by the operator while actuating the switch. Hence such switches were entirely out of the question for light weight radios.

With these objections in mind, it is an object of this invention to provide a simple, exceptionally compact and inexpensive combination push-pull switch and variable resistor which is so designed that the switch can be op-

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erated not only without affecting the setting of the variable resistor, but with a relatively light force, so as to render the combination unit of this invention especially well suited for use on small, light weight table model radios, as well as the larger and heavier radio and television receivers.

More specifically, it is an object of this invention to provide a combination push-pull electric switch and variable resistor in which the switch component incorporates an improved switch mechanism of the overcenter type which assures highly desirable and positive snap-action of the mechanism, wiping engagement between its stationary and movable contacts, and renders old space consuming reorientation of the switch parts unnecessary.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a view partly in side elevation and partly in longitudinal section illustrating a combined variable resistor and snap switch embodying the principles of this invention, and showing the switch in closed position;

Figure 2 is a view similar to Figure 1, but illustrating the switch in open position;

Figure 3 is a cross sectional view taken through Figure 2 along the plane of the line 3—3; and

Figure 4 is a fragmentary detail view taken along the line 4—4 in Figure 1.

Referring now more particularly to the accompanying drawing in which like numerals indicate like parts, the combination electrical control instrumentality of this invention comprises a variable resistor 5 and an electric switch 6 at the rear of the resistor, both components of the instrumentality being actuatable by a common operating shaft 7 projecting into the variable resistor from the front thereof.

Except as noted hereinafter, the variable resistor is of conventional construction. It comprises a housing 8 having spaced substantially parallel front and rear walls 9 and 10, respectively, and a cylindrical sheet metal side wall 11 extending between and joining the front and rear walls. As shown, the rear wall may be integral with the side wall, and it is provided with a large central opening 13 therein for a purpose to be described later.

The front wall 9 of the variable resistor is provided by an insulating base which has the stator assembly of the resistor secured to its inner face. This stator assembly includes a conventional type of arcuate strip-like resistance element 15 of carbonaceous material, and a collector ring 16, both surrounding and mounted coaxially with a hole 17 in the center of the insulating base 9. A contact carrier 18 of insulating material, shown as of the molded type, is interposed between the stator assembly and the rear wall 10 of the housing, and has an annular rib 19 projecting axially from its rear into engagement with the rear wall 10 to define the rearmost axial position of the contact carrier in the resistor housing. The body portion of the carrier is provided with a central non-circular hole 20 leading entirely therethrough so as to open to the well 21 defined by the axially rearwardly projecting rib 19 on the carrier.

According to this invention, the operating shaft 7 is

carried by the front wall or base 9 of the variable resistor for rotary motion about its longitudinal axis so as to provide for actuation of the variable resistor, and for endwise back and forth motion so as to provide for actuation of the electric switch 6. For this purpose, the shaft is freely rotatably and slidably received in a bushing 23 having its inner end secured in the hole 17 in the base 9 and having a threaded forward portion which provides for securement of the combined electrical control instrumentality to the back of a panel or the like.

The contact carrier 18 is mounted on the inner end portion of the operating shaft and is slidably splined thereto so as to rotate with the shaft while allowing endwise sliding motion of the shaft relative thereto. For this purpose, the rear end portion of the operating shaft has a non-circular or flattened cross section, as indicated at 25, which conforms to the shape of the non-circular hole 20 in the carrier, and by which the shaft may be moved endwise a substantial distance relative to the contact carrier while maintaining the latter drivingly connected with the shaft for rotation therewith.

It will be understood, of course, that rotation of the operating shaft is transmitted to the contact carrier 18 for the purpose of adjusting the positions of contact fingers 26 and 27, respectively, fixed on the front face of the carrier, with relation to the resistance element and collector ring 15 and 16 upon which the fingers track; and that the abutting engagement of the annular rib 19 on the back of the carrier with the rear wall 10 of the housing serves to hold the contact fingers engaged with the components of the stator assembly with the proper degree of spring tension.

The electric switch 6 of this invention is mounted in a housing 29 mounted on the back of the resistor housing. It comprises a cylindrical sheet metal side wall 30 of substantially the same diameter as the side wall of the resistor housing, and a rear wall 31 of insulating material and providing a terminal head closing the back of the switch housing. The front of the side wall 30 abuts the rear wall 10 of the resistor housing and has a plurality of circumferentially spaced ears 33 projecting forwardly therefrom through slits (not shown) in the rear wall 10 of the variable resistor housing and bent over upon the forward face of the wall 10 to secure the two housings together. The ears 33 preferably hold the switch housing on the back of the resistor housing with the rear walls of the two housings in spaced parallel relation and with the side walls of the two housings coaxial with one another. With this arrangement, the interior of the switch housing is in open communication with the well 21 in the back of the contact carrier 18 through the large central opening 13 in the rear wall of the resistor housing.

The housing 29 contains switch mechanism which includes a pair of substantially flat spaced apart stationary contacts 35 overlying the front face of the terminal head 31 and fixed thereto with terminal portions 36 thereon projecting rearwardly through suitable openings (not shown) in the terminal head. The switch mechanism also includes an elongated bridging contactor 38 having a pair of fixed contact portions or buttons 39 on its rear surface near the opposite ends of the contactor and each cooperable with one of the stationary contacts 35.

The bridging contactor 38 is fixed to the outer end portion of an elongated, substantially flat switch arm 40, with an insulator 41 interposed therebetween. The arm 40 substantially flatwise overlies the terminal head and extends transversely across the switch housing with the contactor disposed at the rear of the arm. The inner end portion of the switch arm is bifurcated to define spaced parallel fingers 42, the extremities of which are pivotally received in transversely opposite notches 43 in the upstanding flanges 44 of a channel-shaped actuating member 45. The web of the actuating member 45 faces outwardly, toward the side wall of the switch housing,

and flatwise seats upon the web of a channel-shaped guide member 46 having flanges 47 which project upwardly therefrom and loosely embrace the flanges of the actuating member. One end of the guide member 46 is fixed to the terminal head as at 49 to dispose the guide member substantially perpendicular to the terminal head 31 and with its web 50 remote from the stationary contacts 35 of the switch.

The guide member, therefore, not only supports the actuating member 45 in the switch housing, but serves to guide the actuating member for fore and aft translating motion toward and from the terminal head 31 along a path normal thereto. The notches 43 in the outer edges of the actuating member flanges provide a fulcrum for the bifurcated end of the switch arm 40, to enable the switch arm to tilt back and forth in the switch housing in directions to carry the contact points 39 on the bridging contactor to and from engagement with the stationary contacts 35 of the switch.

In order to assure a highly desirable snap action for the switch arm and the maintenance of good contact pressure between the points 39 and their cooperating stationary contacts in the switch closed position, the switch mechanism of this invention is of the overcenter type. For this purpose, the switch mechanism is provided with a helically coiled tension spring 52, connected in overcenter relation between the switch arm 40 and a stationary part on the switch housing. The spring has a diameter such as to readily pass between the bifurcations 42 on the inner end of the switch arm, and one end thereof is hooked into a hole 53 in the arm adjacent to the base of the bifurcations, but centrally thereof. The other end of the spring passes through a clearance slit 54 in the web of the actuating member 45 and engages around an anchor 55 on the web of the guide member 46, outwardly of the pivoted end of the switch arm.

The tension spring thus at all times exerts a force on the switch arm tending to hold its pivoted end in the fulcrum defining notches 43 and to maintain the actuating member nested in its guide member. The spring also acts upon the arm to yieldingly maintain it tilted either forwardly or rearwardly depending upon whether its fulcrum is disposed forwardly or rearwardly of a straight line along which force is exerted on the arm by the spring.

Thus, in the switch closed position shown in Figure 1, the fulcrum for the bifurcated end of the switch arm lies a short distance forwardly of the axis of the tension spring 52, or forwardly of the straight line along which force is applied to the switch arm by the spring, and the latter accordingly holds the switch arm tilted rearwardly with its contact points 39 firmly engaged with the stationary contacts 35 on the terminal head. The switch is operated to the switch open position as a consequence of forward tilting motion of the switch arm, away from the terminal head, and such actuation of the switch is effected by rearward sliding motion of the actuating member 45 toward the terminal head a distance sufficient to carry the fulcrum for the switch arm rearwardly beyond the straight line along which force is exerted upon the switch arm by the tension spring.

The switch open position shown in Figure 2 is defined jointly by the engagement of the rear end of the actuating member 45 with the inner face of the terminal head 31, and by the engagement of the outer end portion of the forwardly tilted switch arm with a tab 57 on the switch housing struck inwardly from the side wall 30 thereof and lying against the rear wall 10 of the resistor housing. The switch closed position shown in Figure 1 is defined jointly by the engagement of the contact points 39 with the stationary contacts on the terminal head, and by the engagement of a stop 59 on the actuating member with the rear wall 10 of the resistor housing adjacent to the edge of the large central aperture 13 therein. The stop 59 is shown as being bent radially inwardly

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of the switch housing from a forward extension of the web of the actuating member.

One of the advantages of the switch of this invention is that it operates with a pronounced snap action. This snap action, of course, results from the connection of the tension spring 52 between the switch arm and a stationary part on the switch housing in overcenter relation with respect to the switch arm and the shiftable fulcrum upon which its inner or bifurcated end portion tilts.

Another feature of the switch mechanism of this invention resides in the fact that both the "make" and the "break" of the switch are accompanied by a highly desirable rolling and/or wiping action of the convex points 39 upon the flat surfaces of the stationary contacts 35. This latter feature results from the fact that operation of the snap switch mechanism requires forward and rearward translation of the fulcrum upon which the bifurcated end portion of the switch arm is supported, so that as the fulcrum moves in either direction along a path which is perpendicular to the terminal head and the surfaces of the stationary contact thereon, the switch arm is simultaneously shifted lengthwise and thereby caused to rock upon its contact points when the latter are engaged with the stationary contacts.

As stated previously, the same operating shaft 7 by which the variable resistor 5 is actuated is also relied upon to effect actuation of the switch mechanism between its open and closed positions, but without necessitating any change in the setting of the variable resistor. For this purpose, the rotatable and endwise slidable operating shaft 7 of the instrumentality is drivingly connected with the actuating member 45 of the switch mechanism by means which is effective only upon back and forth endwise sliding movement of the shaft. This connection is provided by a forward and inward extension of the stop portion 59 on the actuating member, terminating in a fork-like foot or actuator 61 directly behind the operating shaft. The bifurcations of the actuator 61 loosely straddle a reduced coaxial neck 62 on the rear end of the shaft and are confined between the end of the shaft and a head 63 on the rear extremity of the neck.

When the operating shaft 7 is pushed rearwardly toward and through the enlarged opening 13 in the rear wall of the resistor housing, therefore, it propels the actuating member 45 of the switch rearwardly with it, through the engagement of the rear end of the shaft with the actuator 61, to the extreme of rearward motion defined by the engagement of the actuating member with the terminal head 31 of the switch housing.

During such shaft produced rearward motion of the actuating member, and substantially at the time the actuating member carries the pivoted end portion of the switch arm to and slightly beyond the straight line along which force is exerted on the arm by the tension spring, the spring acts upon the switch arm to suddenly snap the same to its forwardly tilted switch open position seen in Figure 2.

Attention is directed to the fact that such operation of the switch mechanism to actuate the same to the switch open position does not entail any rotary motion of the operating shaft such as would change the setting of the variable resistor. In a similar manner, except for forward endwise sliding motion of the operating shaft, the switch may be actuated to its closed position from the open position seen in Figure 2, without entailing any rotation of the operating shaft or alteration in the setting of the variable resistor.

Again, during such forward endwise motion of the operating shaft from its innermost position seen in Figure 2, the switch arm will be snapped rearwardly upon its forwardly moving fulcrum as soon as the latter is carried to and slightly beyond the straight line along which force is exerted upon the switch arm by the tension spring.

The extreme of inward endwise motion of the operat-

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ing shaft may be defined either by the engagement of the rear end of the actuating member 45 of the switch with the terminal head 31 of the switch housing, as shown; or by the direct engagement of a stop, such as the rearwardly facing shoulder 65 defined by the junction between the cylindrical and non-circular rear end portions of the operating shaft, with the front face of the contact carrier 18 when the shaft is in its depressed position seen in Figure 2. In the latter event, the rearward thrust of the shaft would be harmlessly transmitted to the rear wall 10 of the resistor housing through the contact carrier 18.

It is important to note, however, that no forward axial force is imposed upon the contact carrier 18 of the variable resistor during closure of the switch. This results from the fact that forward motion of the operating shaft 7 necessary to close the switch is limited by the engagement of the stop 59 on the actuating member with the rear wall 10 of the resistor housing. Thus, in the forward limit of motion of the operating shaft seen in Figure 1, the non-circular rear end portion of the shaft map project a very slight distance from the body portion of the contact carrier and into the well 21 in its rear, while the fork-like actuator 61 with which it is connected is spaced a slight distance rearwardly from the bottom of the well 21 in the contact carrier.

The combination electrical instrumentality described features simplicity, reliable over-center snap actuation of the switch by substantially small forces exerted on the operating shaft, and a degree of compactness which was previously sought but never attained in combination variable resistor and switch instrumentalities of the type herein concerned. These features are assured partly through the provision of a switch incorporating a switch which extends transversely across the interior of the switch housing and is supported on a forwardly and rearwardly shiftable fulcrum for tilting motion substantially flatwise toward and from the terminal head about an axis crosswise of the operating shaft; and partly by having the actuator 61 of the switch mechanism project through the opening 13 in the rear wall of the resistor housing to be accommodated in a well in the rear of the contact carrier of the resistor in the switch closed position.

From the foregoing description taken together with the accompanying drawing, it will be readily apparent to those skilled in the art that this invention provides an improved combination variable resistor and electrical switch featuring compactness and an extremely simple and reliable snap switch mechanism which may be operated by endwise back and forth sliding motion of the common operation shaft of the instrumentality without in anywise affecting the setting of the variable resistor.

What is claimed as our invention is:

1. An electric snap switch comprising: a housing having a cylindrical side wall and having a substantially flat wall of insulative material providing a terminal head closing the rear of the housing; a pair of stationary contacts fixed on the inner side of the terminal head and having forwardly facing contact surfaces transversely spaced from the side wall and from one another along substantially a diameter of the housing so as to be located at substantially the widest part of the housing; a T-shaped contactor in the housing having its head electrically insulated from its stem and transversely overlying the stationary contacts, the stem of the contactor crossing the housing axis and having its base closely adjacent to the side wall of the housing; an actuating member adjacent to the base of the contactor; means on said actuating member supporting the T-shaped contactor at its base for back and forth pivotal motion about an axis parallel to the terminal head so that the head of the contactor may be swung toward and from the terminal head between a rearwardly tilted contact bridging position and a forwardly tilted switch open position; a spring connected in overcenter relation between the contactor and a fixed part on the housing for yieldingly holding the con-

tactor in either its forwardly or rearwardly tilted positions; guide means fixed on the housing near the side wall thereof and supporting the actuating member for motion in opposite directions axially of the housing to carry the pivoted base of the contactor toward and from the terminal head, to one side or the other of a straight line along which biasing force is exerted on the contactor by said overcenter spring; and means on said actuating member providing an actuator adjacent to the front of the housing by which the actuating member may be shifted back and forth so as to effect snap actuation of the contactor in either direction as a consequence of shifting of said actuating member in the opposite direction to and beyond a position at which the pivoted base of the contactor stem passes through said line along which biasing force is exerted on the contactor.

2. The electric snap switch set forth in claim 1 wherein said guide member is a channel-shaped part having one end fixed to the terminal head, said part projecting forwardly from the terminal head and having a web disposed close to but spaced from the housing side wall and parallel to the housing axis, and flanges which face away from the housing side wall and extend axially of the housing, the actuating member resting upon the web of said channel-shaped part and being loosely embraced by the flanges thereof so as to be guided by said channel-shaped part for back and forth sliding motion in the housing.

3. In an electrical instrumentality of the character described: housing means providing a switch compartment having a cylindrical side wall, a centrally apertured front wall, and an end wall closing the rear of the compartment; a pair of stationary contacts fixed on the inner side of said end wall, said stationary contacts having forwardly facing contact surfaces thereon transversely spaced from one another and from said side wall and located at one side of but close to a plane containing the axis of the compartment, at substantially the widest part of the compartment; a channel-shaped guide member having one end fixed to said end wall at the other side of and remote from said plane, said guide member extending forwardly toward the front wall of the compartment and having a web which is parallel to said plane, and transversely spaced axially extending flanges projecting toward said plane; an actuating member loosely received in said channel-shaped member and guided thereby for back and forth sliding motion along a path parallel to the com-

partment axis, between limits defined by the engagement of said actuating member with the front and rear walls of the compartment; a T-shaped contactor having its head electrically insulated from its stem and transversely overlying and cooperable with the stationary contacts to bridge the same, the base of said stem being located adjacent to the actuating member; means on the actuating member supporting the T-shaped contactor at its base for bodily movement therewith and for back and forth pivotal motion relative to the actuating member about an axis crosswise of the compartment and parallel to said plane, between a rearwardly tilted contact bridging position and a forwardly tilted switch open position; a spring connected in overcenter relation between the contactor and a part on the guide member for yieldingly holding the contactor tilted either forwardly or rearwardly, and operable to effect snap actuation of the contactor in either direction as a consequence of sliding motion of the actuating member in the opposite direction to and beyond a position intermediate its limits of motion at which the pivoted base of the contactor passes through a straight line along which biasing force is exerted on the contactor by said spring; and means on the actuating member providing an actuator by which the actuating member may be shifted back and forth so as to effect snap actuation of the contactor from one position to the other, said actuator having a portion disposed centrally of the switch compartment, adjacent to the front thereof, and which portion is movable outwardly through the aperture in the front wall of the compartment to carry the actuating member to its forward limit of motion.

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CERTIFICATE OF CORRECTION

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July 22, 1958

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 34, strike out the syllable "ing" ; column 6, line 21, for "map" read -- may --; line 33, after "switch", second occurrence, insert -- arm --; column 7, line 34, for "stationarly" read -- stationary --.

Signed and sealed this 28th day of October 1958.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

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