June 9, 1953 A. W. KRIEGER 2,641,663

ELECTRIC SWITCH

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Fig. 1

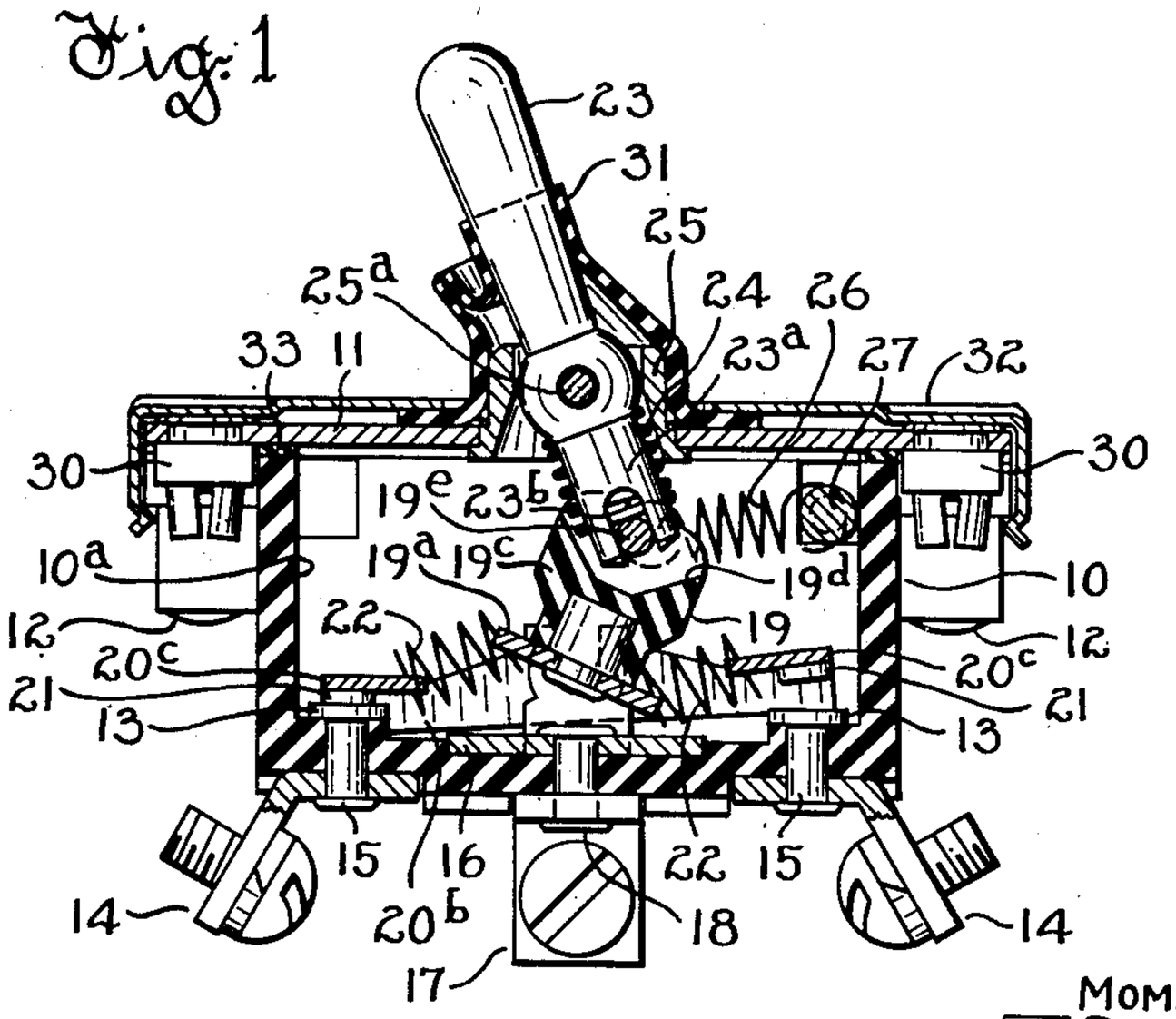


Fig. 2

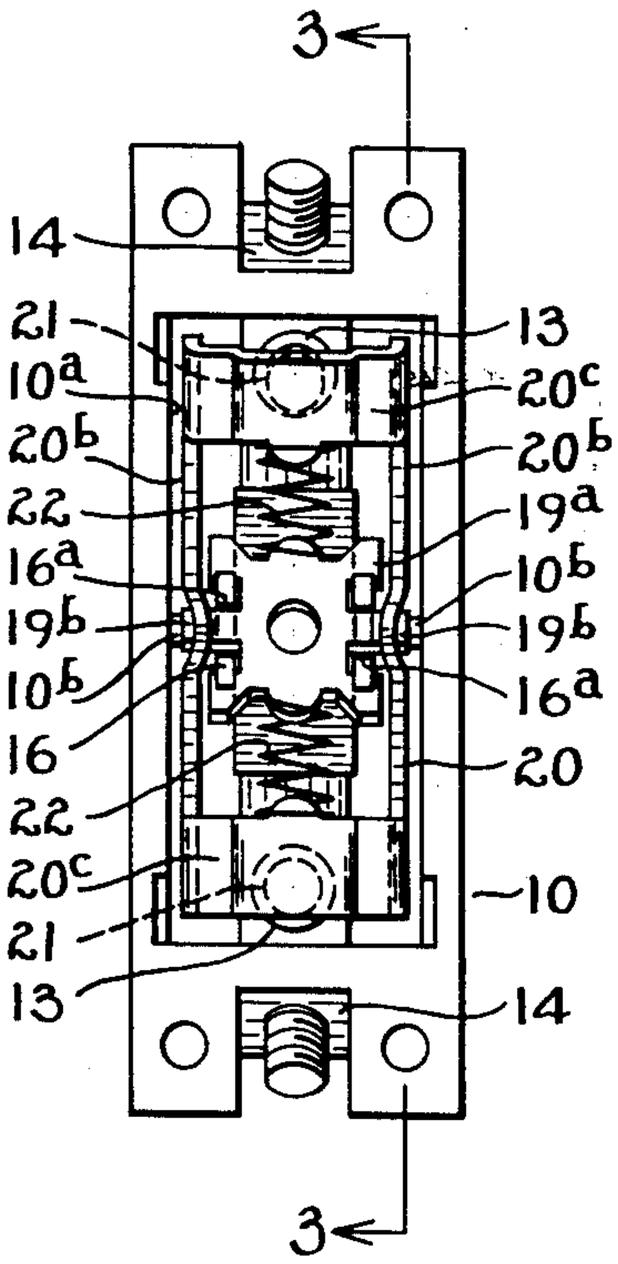
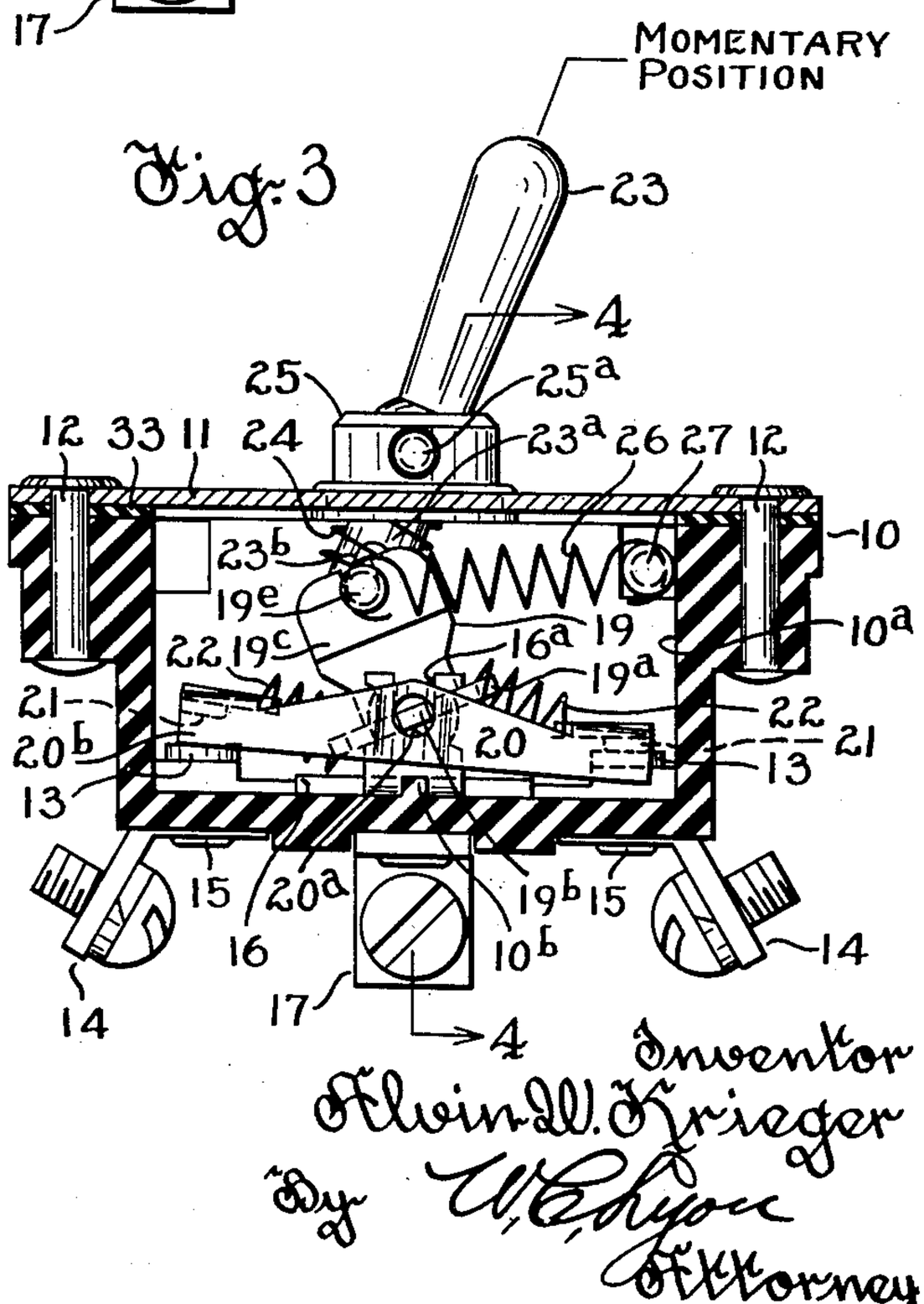


Fig. 3



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Fig. 4

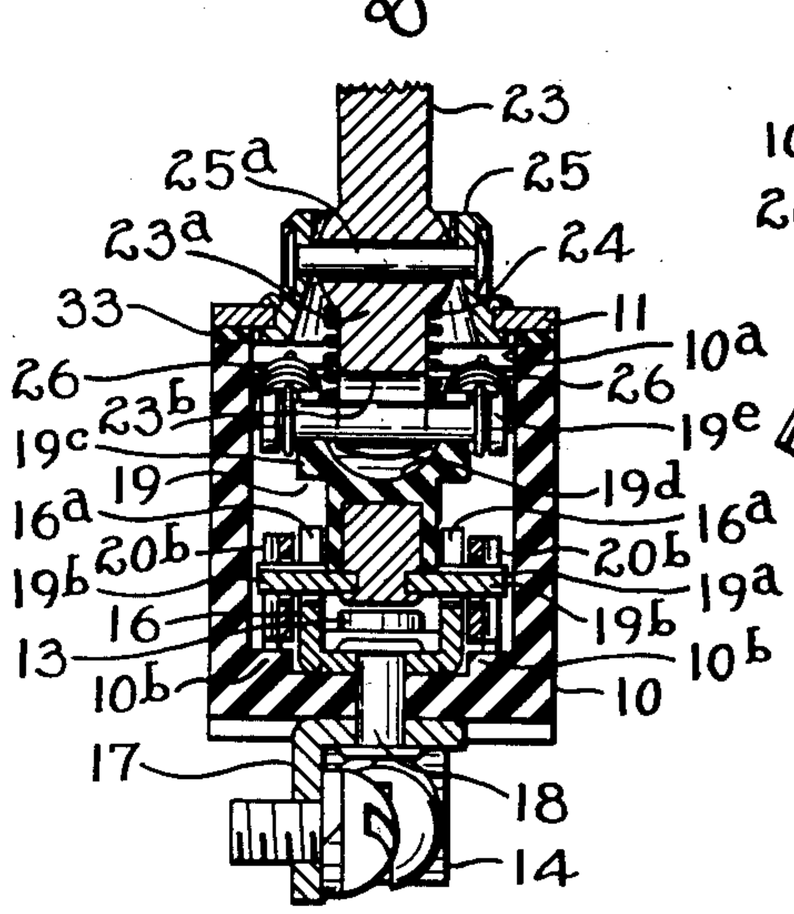


Fig. 5

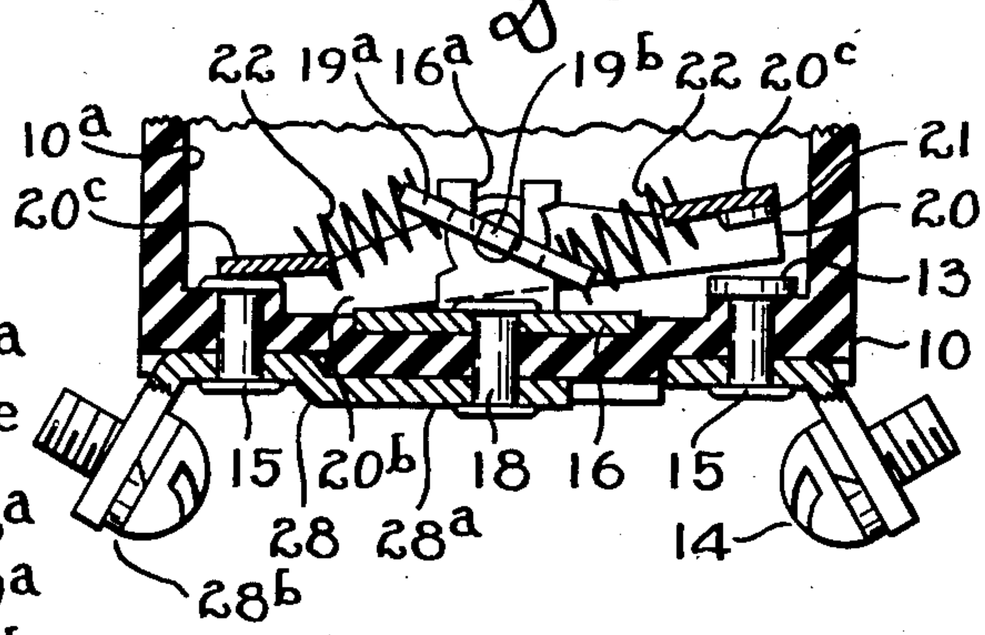


Fig. 6

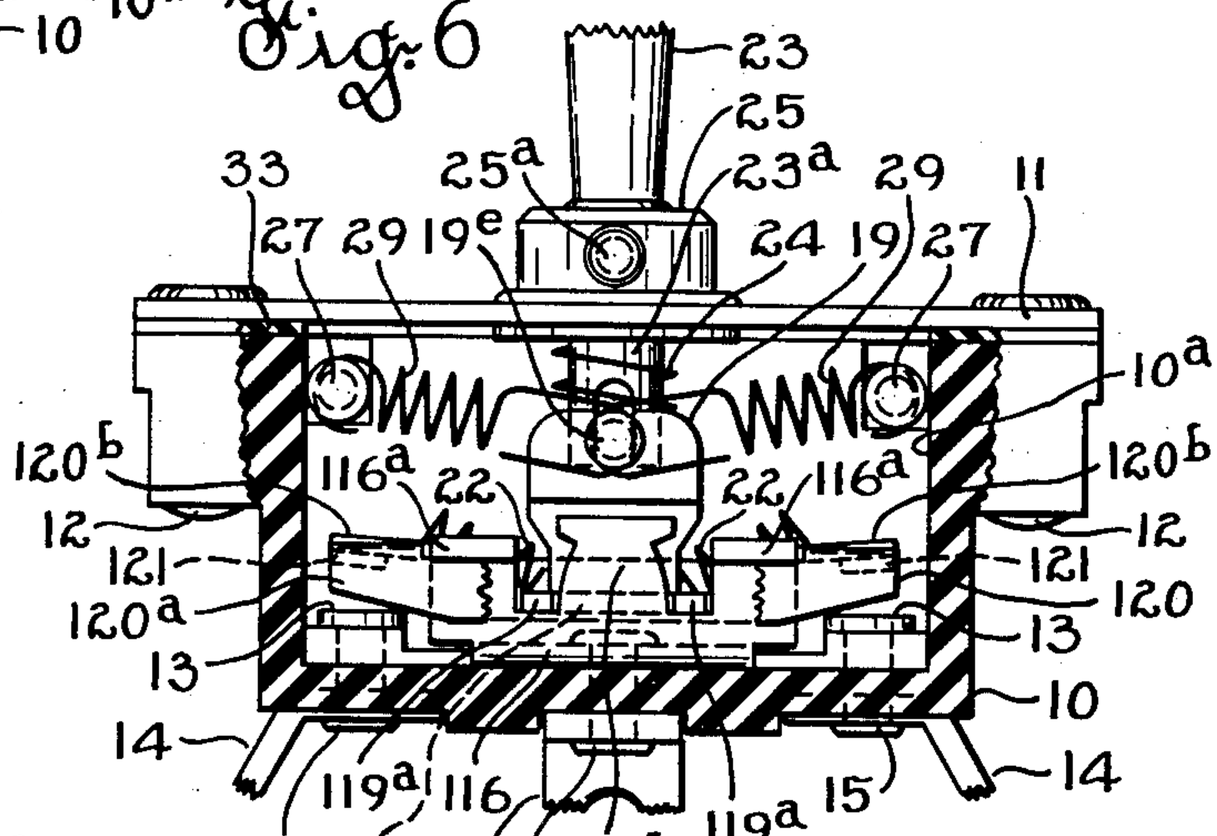


Fig. 7

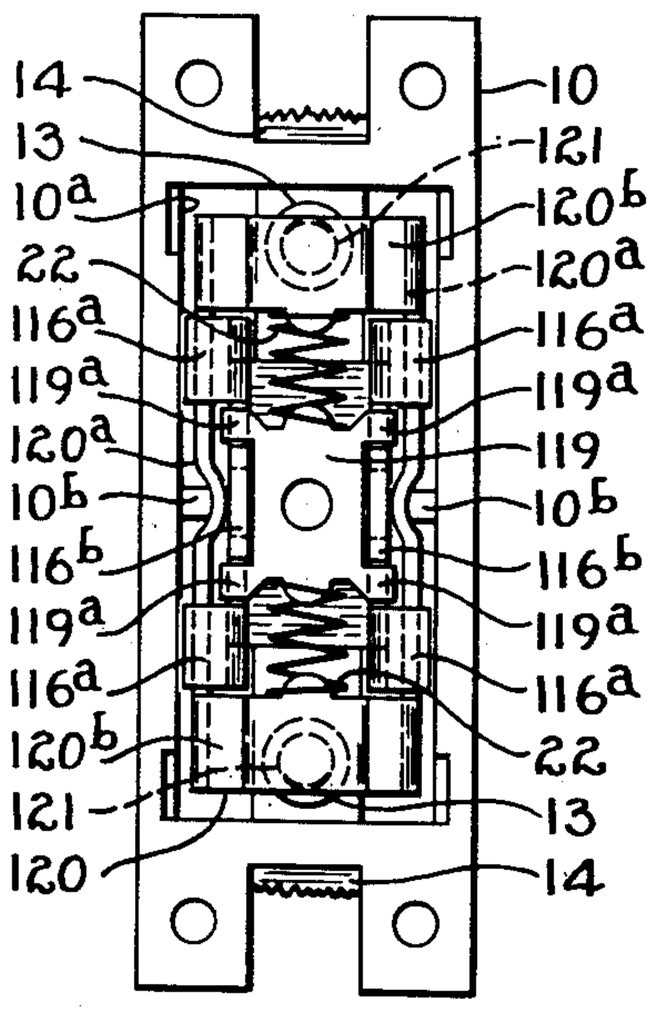
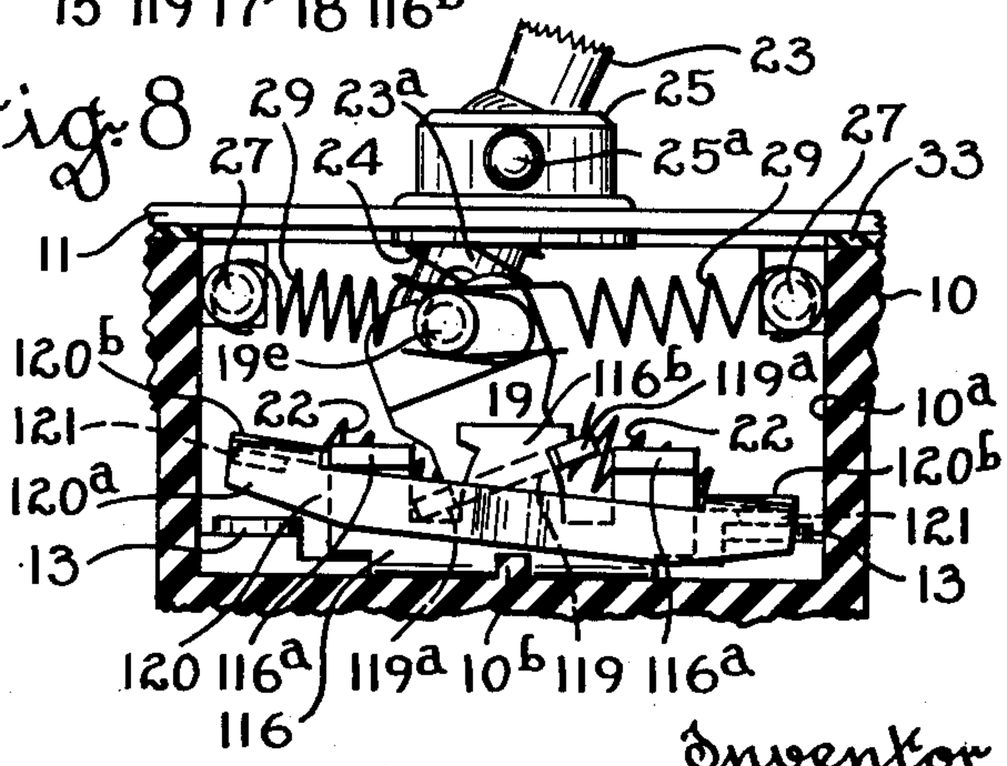


Fig. 8



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2,641,663

ELECTRIC SWITCH

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7 Claims. (Cl. 200—67)

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This invention relates to an electric switch, and more particularly to a switch adapted to selectively control a plurality of electric circuits; which, while not limited thereto, may be advantageously utilized in aircraft or the like where high capacity and a high degree of dependability and ruggedness in switches of small sizes are requisite.

A primary object is to provide a switch of the character described wherein opening and closure of its contacts is accomplished with a snap action not subject to "teasing" and wherein such snap action is secured by means not requiring lubrication.

Another object is to provide a switch of the character described wherein simultaneous closure of more than one of the circuits controlled is rendered impossible.

Another object is to provide a switch of the character described affording various circuit controlling characteristics by the addition, and omission or substitution of a relatively small number of parts.

Another object is to provide an extremely simple and compact snap switch mechanism of the aforementioned character, and more particularly to improve the details of construction and assembly of the parts and the operation of switch mechanisms affording the characteristics desired as hereinbefore described.

Another object is to provide in a switch of the character described, simplified spring means affording momentary positioning of the switch parts.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate certain embodiments of the invention which will now be described, it being understood that the embodiments illustrated are susceptible of modification as to certain details of construction thereof without departing from the scope of the appended claims.

In the drawings,

Figure 1 is a center line longitudinal sectional view of a double throw, two position switch constructed in accordance with the invention and further illustrating means affording a momentary characteristic to one of the switch positions.

Fig. 2 is a top plan view of the switch illustrated in Fig. 1 with the mounting plate and operating means associated therewith removed to expose other switch parts.

Fig. 3 is a sectional view taken on the broken line 3—3 of Fig. 2, but with the switch parts in a second or momentary position of the switch illustrated.

Fig. 4 is a sectional view taken on the broken line 4—4 of Fig. 3.

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Fig. 5 is a fragmentary sectional view of a modified form of the switch affording a single throw, two-position switch, the switch parts being shown in the "off" position.

Fig. 6 is a side elevational view, with certain parts broken away for sake of clarity, illustrating a modification of the switch to afford a double throw, three-position switch, and additionally illustrating means for rendering each of the two "on" positions momentary; the switch parts being shown in the "off" position.

Fig. 7 is a top plan view of the switch illustrated in Fig. 6 but with the mounting plate and parts associated therewith removed to expose the other switch parts.

Fig. 8 is a fragmentary view similar to that of Fig. 7 illustrating the switch parts in one of their "on" positions.

Referring to the drawings, the reference numeral 10 designates a one-piece molded insulating base common to all of the various forms of the switch to be hereinafter described, said base being adapted to enclose and support the various switch parts. Base 10 has a recess 10a opening to the upper surface thereof and to be covered by a mounting plate 11 of well known form attached to the base as by rivets 12.

Referring primarily to Figs. 1 to 4, inclusive, illustrating a single pole, double throw, two-position switch embodying the invention, the reference numeral 13 designates a pair of stationary contacts preferably rigidly and permanently attached to the bottom wall of recess 10a and each electrically connected to a terminal lug 14 of well known form as by rivets 15. Also preferably rigidly and permanently attached to the bottom wall of recess 10a is an electrically conductive U-shaped frame 16 electrically connected to a centrally located common terminal lug 17 as by a rivet 18 (Fig. 4).

As best shown in Fig. 3, each of the upstanding arms of frame 16 is provided with a U-shaped slot 16a extending downwardly from the top edge thereof to afford an open pivotal bearing for a toggle member 19 and more particularly for a plate-like portion thereof 19a having ears 19b extending outwardly through the aforementioned slots 16a, as best shown in Figs. 2 and 4. As best shown in Figs. 2 and 3, said aforementioned ears 19b additionally provide a pivotal support for an electrically conductive rocking element or contactor 20, the latter having openings 20a in the respective sides 20b thereof through which said ears 19b extend.

As best shown in Fig. 2, rocking element 20 is formed of parallel side portions 20b positioned outside of the arms of frame 16 and pivotally supported at the center by member 19 and hence by frame 16 as hereinbefore described, and has

integrally formed connecting portions 20c at each end thereof. Each of the aforementioned portions 20c carries a contact 21 (Fig. 1) to cooperate with one of the aforedescribed stationary contacts 13.

A pair of helical over-center compression springs 22 (Fig. 3) are individually connected between each contact carrying end of rocking element 20 and plate 19a of toggle member 19.

Member 19 additionally comprises an insulating portion 19c (Figs. 1 and 3) rigidly and permanently attached to plate 19b in a well known manner. As best shown in Figs. 1 and 4, insulating portion 19c is recessed at the upper end thereof as at 19d to accommodate the lower end 23a of an operating lever 23 of well known form and additionally is provided with a pin 19e extending transversely of said recess, the aforementioned lower end 23a being slotted as at 23b (Fig. 1) to afford a sliding linkage with pin 19e and hence with toggle member 19. A helical compression spring 24 surrounding the lower portion 23a of lever 23 is adapted to abut pin 19e and bias toggle member 19 as a whole downwardly.

The upper end of operating lever 23 extends through a suitable bushing 25 attached to mounting plate 11 in a well known manner, which bushing is provided with a transversely extending pin 25a affording a pivotal support for lever 23.

As will be apparent, movement of operating lever 23 to and from its extreme positions will rock toggle member 19 about its centrally located pivotal point 19b in frame 16 as aforedescribed, which rocking movement will in turn be transmitted to contact carrying element 20 through over-center springs 22 to rock element 20 in reverse directions selectively for engaging it through its contacts 21 with the stationary contacts 13 selectively. Oscillation of element 20 in response to movement of toggle member 19 will, of course, occur each time the over-center springs 22 pass through center and will therefore result in engagement and disengagement of the contacts with a snap action which is substantially immune to "teasing." Moreover such snap action is achieved through the use and arrangement of parts heretofore described which require no lubrication and hence assure dependable operation in ambient temperature frequently encountered in aircraft or the like.

Similarly it will be apparent that the switch affords a flow of electric current from one or the other of the outside terminal lugs 14 through one or the other of the stationary contacts 13 and its respective cooperating contact 21, according to the direction in which element 20 is rocked, and thence through plate 19 and frame 16 to common terminal lug 17, wherefore the switch is adapted to selectively close one or the other of a plurality of controlled circuits. Moreover since contact carrying element 20 is centrally pivoted as at 19b it will be seen that engagement of element 20 with more than one contact 13 at a time is rendered impossible. Furthermore over-center springs 22 bias the respective ends of element 20 in opposite directions in both positions of the switch.

Additionally illustrated in Figs. 1 to 4, inclusive, are means to bias the switch to one of its circuit controlling positions thereby to render the remaining position momentary. As best shown in Figs. 3 and 4, such means take the form of a pair of helical tension springs 26, the ends of which are removably connected between a pin 27 held by base 10 transversely of one end of recess 10a and pin 19e, respectively, said springs 26 being attached to pin 19e outside of toggle member 19, as best shown in Fig. 4. Springs 26 will, of course, be of sufficient strength to overcome the bias of over-center springs 22. As will be apparent, the aforedescribed arrangement provides a simple method of rendering, according to selection, either circuit controlling position momentary only, which arrangement may easily and expeditiously be altered or eliminated without alteration of the remainder of the switch structure.

In Fig. 5 is illustrated a modification of the switch heretofore described to provide a simple "on," "off" snap acting switch for opening and closing a single electric circuit. The switch parts are essentially the same as those hereinabove described, and where illustrated have been given like reference numerals.

However, to afford the desired circuit controlling characteristics, terminal lug 17 and one of the terminal lugs 14 have been omitted, the latter being replaced by a terminal lug 28 having a bus-like extension 28a for electrically connecting frame 16 through rivet 18 to the terminal portion 28b. Also the cooperating contacts 21 and 13 at that end of the switch adjacent the terminal lug 28, may, if desired, be omitted. As will be apparent, the aforedescribed modification may be simply accomplished to achieve the circuit controlling characteristics desired without alteration of the remaining switch parts. Moreover the switch immediately described may be rendered momentary as to either of its positions by the same means heretofore described in connection with the embodiment of the invention illustrated in Figs. 1 to 4, inclusive.

The embodiments shown in Figs. 6 to 8, inclusive, illustrate a further modification of the switch to afford a single pole, double throw, three-position switch having an "off" position intermediate the two "on" positions. In this form certain of the switch parts have been modified to accomplish the desired circuit controlling characteristics. All of the other switch parts are the same as those hereinbefore described and have been given like reference numerals.

Thus the three-position switch about to be described utilizes the same insulating base 10, stationary contacts 13, terminal lugs 14 and 17, mounting plate 11 and operating lever 23 with its associated parts. An electrically conductive U-shaped frame 116 is provided having a laterally extending ear 116a (Fig. 7) at each corner thereof to afford pivotal bearings for a rocking element 120 to be hereinafter described. A pair of upstanding intermediate portions 116b of the contour best shown in Fig. 6 afford an interlock with and a guide for movement of a plate-like portion 119 of a rocking toggle member 19, in other respects identical to the toggle member utilized in the switch embodiments hereinbefore described. As best shown in Fig. 7, portion 119 is notched on opposite side edges thereof to interlock with portions 116b and to form pairs of outwardly extending ears 119a adapted to rest upon frame 116 in the intermediate position of the switch as shown in Fig. 6, or to afford selective pivotal points for said toggle member 19 when rocked to either of its extreme positions, one of such positions being shown in Fig. 8.

Electrically conductive rocking element or contactor 120 is formed of parallel side portions 120a (Fig. 7) and integrally formed connecting portions 120b at each end thereof. As best shown in Figs. 6 and 8, each of the aforemen-

tioned connecting portions 120b carries a contact 121 to cooperate with its respective stationary contact 13. Element 120 is adapted for pivotal movement about one or the other of the pairs of ears 116a at opposite ends of frame 116, said pairs of ears 116a serving alternately as pivotal bearings for element 120 or as stops to limit upward movement of the free end thereof.

The aforementioned movement of element 120 is responsive to reverse movements of toggle member 19 about one or the other of its selective pivotal points afforded by ears 119a as hereinbefore described, such movement being transmitted to element 120 by a pair of over-center helical compression springs 22 connected (as best shown in Fig. 7) individually between opposite ends of element 120 and portion 119 of toggle member 19. As is the case in the embodiments previously described, springs 22 upon going through center afford movement of element 120 with a snap action to effect engagement and disengagement of the respective pairs of cooperating contacts. Similarly in either of the "on" positions, that is, when either of the pairs of contacts are engaged springs 22 bias the ends of element 120 in opposite directions, while when in the intermediate "off" position (Fig. 6) both springs 22 cooperate to bias element 120 upwardly against the stops afforded by ears 116a of frame 116.

As will be apparent, the flow of electric current through either of the circuits controlled will be substantially the same as that afforded by the two-position, double throw switch hereinbefore described in either of the "on" positions, while provision of an intermediate position in which neither of the pairs of contacts are engaged affords an "off" position for the switch in which both of the controlled circuits are interrupted.

It will similarly be apparent that the switch affords selective closure of one or the other of the controlled circuits. Moreover, as best shown in Figs. 4 and 8, base 10 is provided with a pair of integrally formed lugs 10b extending upwardly and outwardly from the bottom and side walls of recess 10a to afford a centrally located auxiliary or emergency pivotal point for element 120 in the three-position form of the switch to render impossible simultaneous engagement of both pairs of cooperating contacts. For example, should one pair of cooperating contacts stick or weld upon engagement, movement of toggle member 19 to its opposite extreme position would cause the bottom edges of element 120 to be driven against lugs 10b to prevent closure of the other pair of cooperating contacts or to pry the welded pair of contacts apart. It will therefore be seen that closure of both of the controlled circuits simultaneously is rendered impossible.

Similarly to the two-position form of the switch previously described, the three-position form illustrated may, if desired, be additionally provided with spring means similar to those heretofore described to render any one or more of the circuit controlling positions of the switch momentary. In the switch shown in Figs. 6 to 8, inclusive, two pairs of springs 29 are removably connected respectively between pins 27 and pin 19e as hereinbefore described, to bias toggle member 19 to its intermediate or "off" position, thus rendering each of the "on" positions momentary only. As will be apparent, either one of said pairs of springs could be omitted thus

to render only one of the "on" positions momentary, or the relatively stronger pair of springs utilized in the two-position form of the switch could be used to bias member 19 to one or the other of its extreme positions to render one of the "on" and the intermediate or "off" position both momentary. Thus it will be seen that the immediately aforedescribed circuit controlling characteristics may be simply and expeditiously varied without disturbance of the remainder of the switch parts, the means provided being easy to assemble and relatively simple to manufacture.

The mounting plates 11 common to all forms of the switch may be provided with self-locking nuts 30 of well known form (Fig. 1) for attachment of the switches to suitable supporting structure. Additionally each of the switches may (as illustrated in Fig. 1) be provided with a dust boot assembly of the type disclosed in my copending application S. N. 64,077, filed December 8, 1948, now abandoned, and comprising a dust boot 31 and clamping means therefor 32. An insulating gasket 33 (Fig. 3) is also interposed between the mounting plate 11 and the top surface of base 10 to electrically insulate the former from the switch parts and to aid in rendering the switches dust-proof.

I claim:

1. A multi-position snap acting switch adapted to selectively control a plurality of electric circuits comprising, in combination, a pair of cooperating contacts for each electric circuit controlled, a rocking element having a plurality of pivotal points and carrying at each of its ends one contact of each of said pairs of contacts, snap acting means for oscillating said element alternately about one or the other of its pivotal points, said means comprising a toggle member having selective pivotal points and a pair of over-center springs individually connected between opposite ends of said element and said toggle member for selective movement of one or the other of said contact carrying ends of said element into and out of engagement with its cooperating contact in response to reverse movements of said toggle member about its pivotal points selectively, said over-center springs biasing the respective ends of said element in opposite directions upon engagement of any of said pairs of contacts.

2. A multi-position snap acting switch adapted to selectively control a plurality of electric circuits comprising, in combination, a pair of cooperating contacts for each electric circuit controlled, an element having a plurality of pivotal points and carrying at each of its ends one contact of each of said pairs of contacts, snap acting means for oscillating said element alternately about one or the other of its pivotal points, a frame having plural parts each affording a pivotal bearing for said element or alternatively affording a stop to limit movement of said element about the other of said pivotal points, said snap acting means comprising a toggle member having selective pivotal points and a pair of over-center springs individually connected between opposite ends of said element and said toggle member for selective movement of one or the other of said contact carrying ends of said element into and out of engagement with its cooperating contact in response to reverse movements of said toggle member about its pivotal points selectively, said over-center springs biasing the respective ends of said

element in opposite directions upon engagement of any of said pairs of contacts and biasing said aforementioned element ends in the same direction upon disengagement of all of said pairs of contacts by movement of said snap acting means to a position intermediate its extreme positions.

3. A multi-position snap acting switch adapted to selectively control a plurality of electric circuits comprising, in combination, a pair of cooperating contacts for each electric circuit controlled, a rocking element having a plurality of pivotal points and carrying at each of its ends one contact of each of said pairs of contacts, snap acting means for oscillating said element alternately about one or the other of its pivotal points, said means comprising a toggle member having selective pivotal points and a pair of over-center springs individually connected between opposite ends of said element and said toggle member for selective movement of one or the other of said contact carrying ends of said element into and out of engagement with its cooperating contact in response to reverse movements of said toggle member about its pivotal points selectively, said over-center springs biasing the respective ends of said element in opposite directions upon engagement of any of said pairs of contacts, and spring means connected to said toggle member biasing said snap acting means to render at least one of its circuit controlling positions momentary.

4. A snap acting switch comprising, in combination, a rocking element having a plurality of longitudinally spaced pairs of supports and having at one end a contact portion, a current carrying support for said element upon which said element has pivotal bearing, a stationary contact to be engaged and disengaged by said contact of said element upon reverse pivotal movements of said element, a rocking toggle member, springs providing an operating connection between said toggle member and said element, and a pair of wiring terminal elements respectively electrically connected with said stationary contact and said current carrying support.

5. A multi-position snap acting switch adapted to selectively control a plurality of electric circuits comprising, in combination, a pair of cooperating contacts for each electric circuit controlled, a rocking element pivotable at either end and carrying at each of its ends one contact of each of said pairs of contacts, snap acting means for oscillating said element alternately about one or the other of its pivotal points, a frame having plural parts each affording a pivotal bearing for said element or alternatively affording a stop to limit movement of said element about the other of said pivotal points, said snap acting means comprising a rocking toggle member having selective pivotal points and a pair of over-center springs individually connected between opposite ends of said element and said toggle member for selective movement of one or the other of said contact carrying ends of said element into and out of engagement with its cooperating contact in response to reverse movements of said toggle member about its pivotal points selectively, said over-center springs biasing the respective ends of said element in opposite directions upon engagement of any of said pairs of contacts, and an auxiliary centrally located pivotal point for said element to render simultaneous engagement of more than one of said pairs of contacts impossible.

6. A multi-position snap acting switch adapted to selectively control a plurality of electric circuits comprising, in combination, an insulating base for enclosing and supporting the switch parts, a pair of cooperating contacts for each electric circuit controlled, a plurality of terminal lugs attached to said insulating base exteriorly thereof, pairs of contacts comprising a stationary contact rigidly and permanently attached to said insulating base and to one of said terminal lugs, an electrically conductive rocking element pivotable at either end and carrying at each of its ends one contact of each of said pairs of contacts, snap acting means for oscillating said element alternately about one or the other of its pivotal points, an electrically conductive frame attached to said base and to a common terminal lug and having plural parts each affording a pivotal bearing for said element or alternatively affording a stop to limit movement of said element about the other of said pivotal points, said snap acting means comprising a rocking toggle member rockingly supported by said frame and having selective pivotal points thereon, and a pair of over-center springs individually connected between opposite ends of said element and said toggle member for selective movement of one or the other of said contact carrying ends of said element into and out of engagement with its cooperating stationary conttact in response to reverse movements of said toggle member about its pivotal points selectively, said over-center springs biasing the respective ends of said element in opposite directions upon engagement of any of said pairs of contacts and biasing said aforementioned element ends in the same direction upon disengagement of all of said pairs of contacts by movement of said snap acting means to an intermediate position, said insulating base having projections affording a centrally located auxiliary pivotal point for said element to render simultaneous engagement of more than one of said pairs of contacts impossible.

7. A three position snap acting switch comprising, in combination, a movable current carrying element having contact portions at opposite ends thereof, stationary contacts positioned for alternative engagement by said movable element, a movable toggle member, compression springs positioned between opposite ends of said toggle member and corresponding contact ends of said movable element, and a current carrying support in electrical contact with said movable element and affording for selective movements of said movable element and said toggle member a plurality of pivotal axes, said switch being convertible to a two position snap acting switch by limiting said movable element and said toggle member to movement about a single axis.

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