

Dec. 1, 1953

J. C. L. SHABECK, JR

2,661,408

ELECTRICAL SWITCH

Filed March 9, 1946

4 Sheets-Sheet 1

Fig. 1.

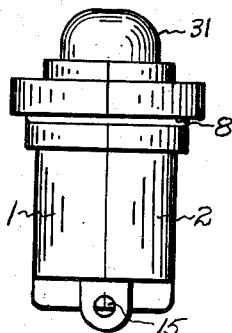


Fig. 2.

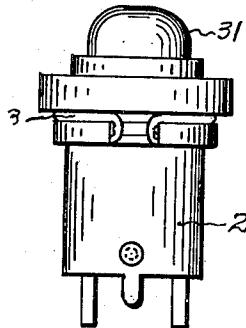


Fig. 3.

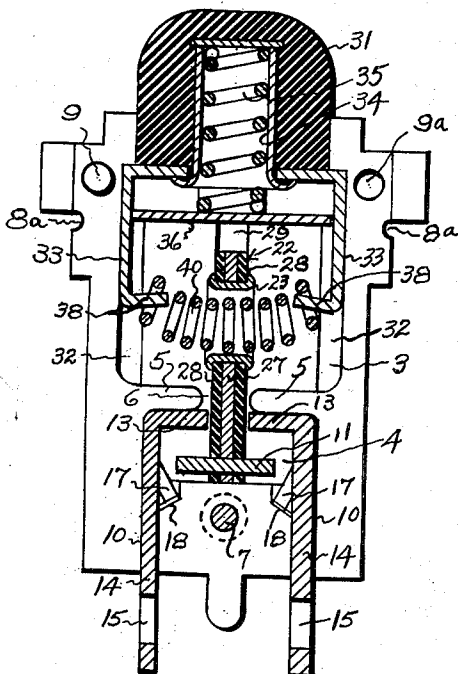
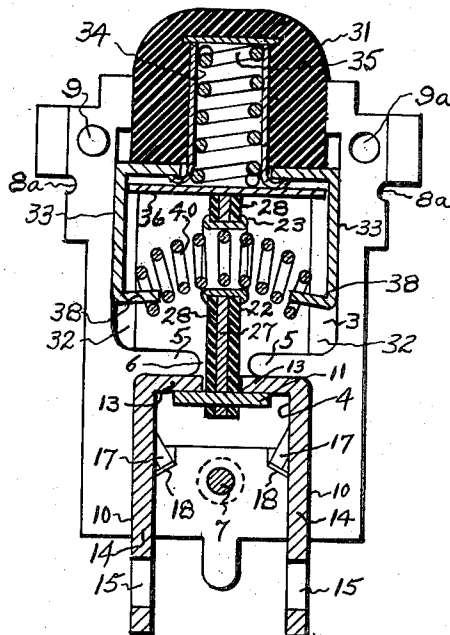


Fig. 4.



Inventor
John C. L. Shaback, Jr.

By **Walter S. Jones**

Attorney

Dec. 1, 1953

J. C. L. SHABECK, JR
ELECTRICAL SWITCH

2,661,408

Filed March 9, 1946

4 Sheets-Sheet 2

Fig. 5.

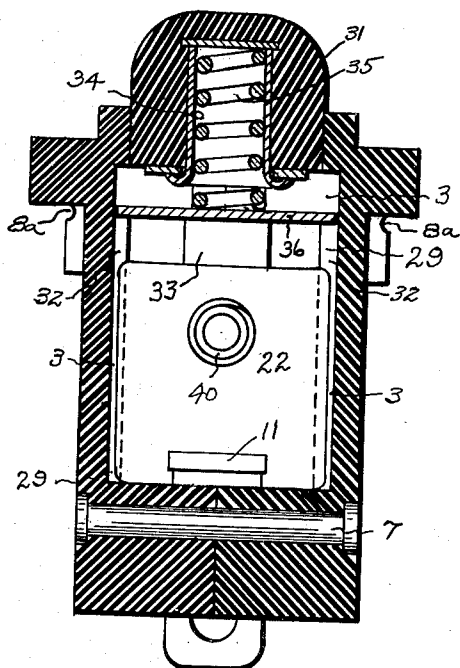


Fig. 6.

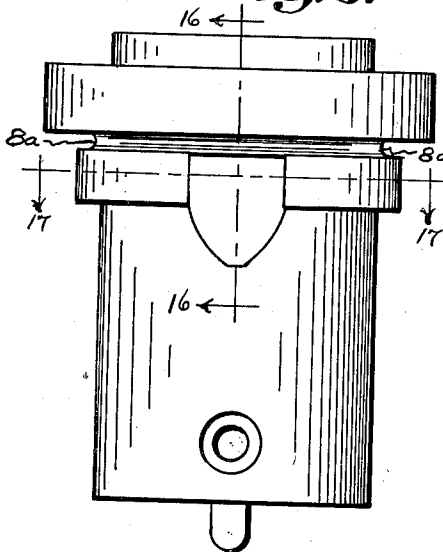


Fig. 7.

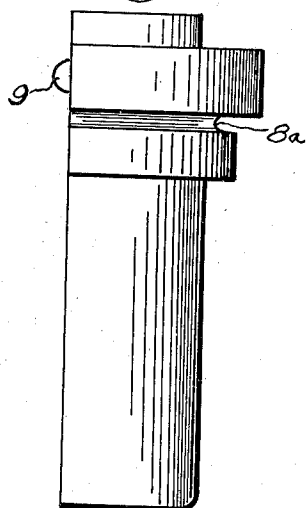
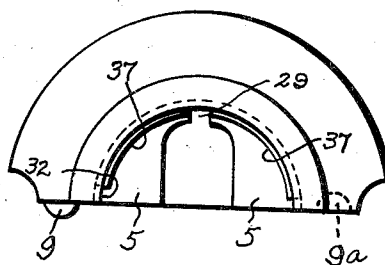


Fig. 8.



Inventor
John C. L. Shabec, Jr.

By **Walter S. Jones**
Attorney

Dec. 1, 1953

J. C. L. SHABECK, JR

2,661,408

ELECTRICAL SWITCH

Filed March 9, 1946

4 Sheets-Sheet 3

Fig. 9.

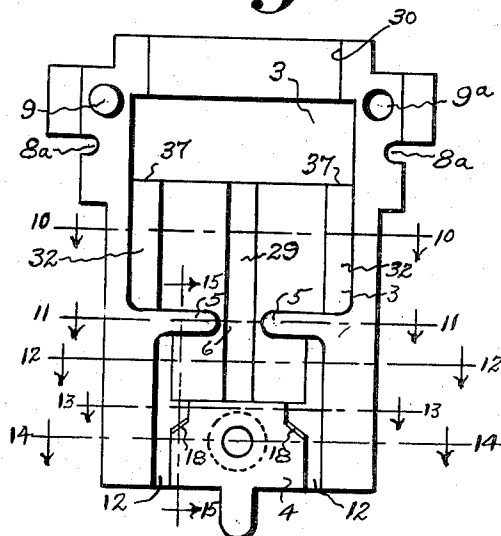


Fig. 10.

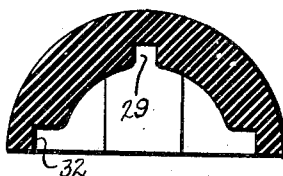


Fig. 11.

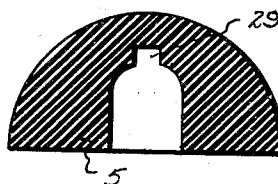


Fig. 12.

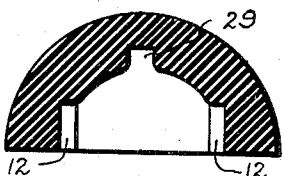


Fig. 13.

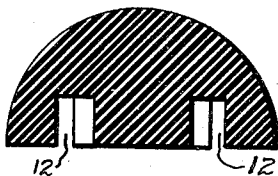


Fig. 14.

Fig. 15.

Fig. 16.

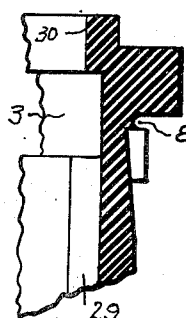
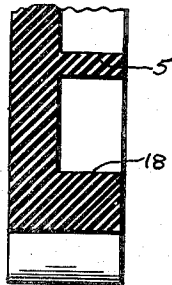
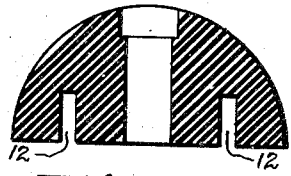
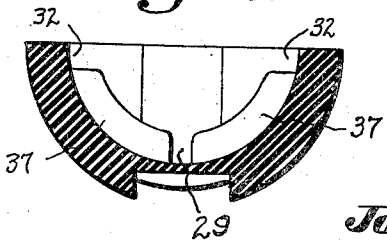


Fig. 17.



Inventor

John C. L. Shabek, Jr.

By *Walter S. Jones*

Attorney

Dec. 1, 1953

J. C. L. SHABECK, JR
ELECTRICAL SWITCH

2,661,408

Filed March 9, 1946

4 Sheets-Sheet 4

Fig. 18. **Fig. 19.** **Fig. 22.**

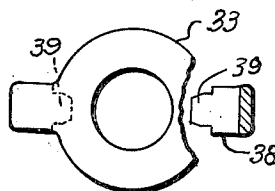
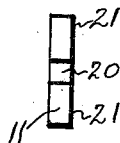
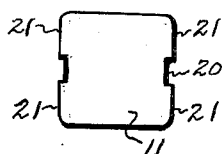


Fig. 20. **Fig. 21.** **Fig. 23.**

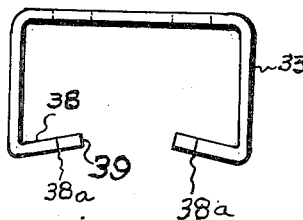
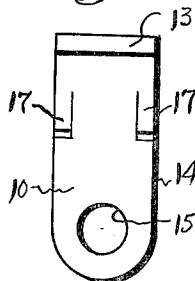
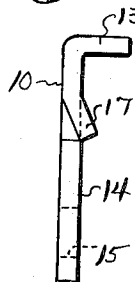


Fig. 24.

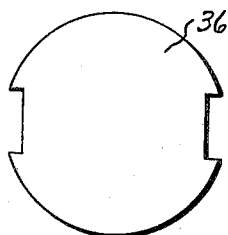


Fig. 25.

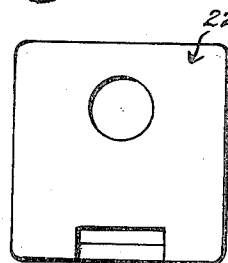
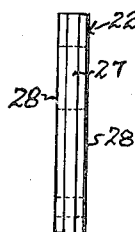
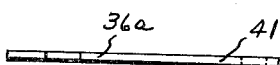
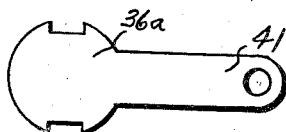


Fig. 26.



Inventor
John C. L. Shabec Jr.

By *Walter S. Jones*

Attorney

UNITED STATES PATENT OFFICE

2,661,408

ELECTRICAL SWITCH

John C. L. Shabeck, Jr., Waltham, Mass., assignor
to United-Carr Fastener Corporation, Cam-
bridge, Mass., a corporation of Massachusetts

Application March 9, 1946, Serial No. 653,372

11 Claims. (Cl. 200—76)

1

The present invention relates to electrical switches and more particularly to switches wherein a movable contact member is moved to opened and closed position by a snap action and the invention aims generally to improve existing switches of that type.

One of the primary objects of the invention is the provision of a snap switch possessing a large contact area, high contact pressure, large contact gap, maximum operating force acting in direction normal to the plane of the contacts, a high rate of contact opening and minimum mass and inertia of the movable contact carrier which contribute to a minimum of contact bounce, thus increasing the serviceability of the switch under relatively heavy loads.

A further aim and object of the invention is the provision of a switch of novel construction and arrangement of parts that may be embodied in a unit of small size.

A still further object of the invention is the provision of a snap action switch of the direct impinging or abutting contact type that will possess improved operating characteristics under relatively heavy loads.

A still further object of the invention is the provision of an electrical switch the parts of which may be readily manufactured and assembled at a minimum cost.

Other aims and advantages of the invention will be apparent to those skilled in the art from a consideration of the following more detailed specification, reference being had to the accompanying drawings wherein:

Fig. 1 is a side elevation of the switch as viewed from one side;

Fig. 2 is a similar view as viewed from the position at right angles to Fig. 1;

Fig. 3 is an enlarged vertical longitudinal sectional view of the switch shown in its open or circuit-broken position;

Fig. 4 is a similar view of the switch shown in its closed or circuit-making position;

Fig. 5 is a sectional view similar to Fig. 3, but taken at right angles thereto;

Fig. 6 is an enlarged outside side elevation of one section of the switch housing;

Fig. 7 is an edge elevation thereof;

Fig. 8 is a top plan view thereof;

Fig. 9 is an enlarged inside elevation thereof;

Fig. 10 is a horizontal sectional view taken on the line 10—10 of Fig. 9;

Figs. 11 to 14 inclusive are similar views taken respectively on the lines 11—11 to 14—14 of Fig. 9;

Fig. 15 is a fragmental vertical sectional view taken on the line 15—15 of Fig. 9;

Fig. 16 is a fragmental vertical sectional view taken on the line 16—16 of Fig. 6;

Fig. 17 is a fragmental horizontal sectional view taken on the line 17—17 of Fig. 6;

2

Fig. 18 is a plan view of the movable contact member;

Fig. 19 is an edge view thereof;

Fig. 20 is an edge elevation of one of the fixed contact members;

Fig. 21 is a front elevation thereof;

Fig. 22 is a top plan view of the operating yoke partly broken away better to illustrate the construction;

Fig. 23 is an edge elevation thereof;

Fig. 24 is a plan and edge view of the washer employed in the improved switch;

Fig. 25 is an edge and face elevation of the carrier employed therein; and

Fig. 26 is a plan and edge view of the grounding plate.

Electrical switches normally are designed and constructed for a predetermined load-carrying capacity. In many installations, for example in aircraft use, operating conditions vary so greatly that a switch having an adequate load-carrying capacity at or near ground levels will be inadequate at high altitudes.

For switches designed for relatively heavy loads contact area is an important consideration. For such uses switches of the direct impinging or abutting contact type are preferable to switches of the sliding contact type. According to the present invention direct impinging or abutting contacts are employed which have exceptionally large contact area which may be embodied in terminals of relatively heavy stock. This permits of the distribution of arcing erosion and the rapid dissipation of heat, imparting longer life and cooler operation to the switch.

However, switches of the direct impinging or abutting contact type are subject to contact bounce which, if permitted, causes arcing across the contacts and erosion of the contact surfaces. In cases where contact bounce is bad, the arc drawn across the contacts may be hot enough to cause welding of the contacts together. Contact bounce is extremely critical when the switch is operating under an inductive load which induces a very high short voltage surge when current flow is interrupted. For example, in certain solenoid operating circuits normally operating at 28 volts D. C., a voltage surge of 300–400 volts is created across the switch contacts as current flow is interrupted.

According to the present invention contact bounce is substantially eliminated or reduced to a minimum by providing a maximum contact opening, a maximum operating force acting in a direction normal to the plane of the contacts, a high rate of contact opening and a minimum mass and inertia of the movable contact carrier, as will be more fully explained in the following description of one suitable embodiment of the invention shown in the drawings.

Referring more particularly to the drawings,

3

the improved switch of the invention conveniently may comprise a housing which, for convenience, is advantageously formed of substantially semi-cylindrical complementary parts 1 and 2 preferably of molded insulating material, each of which may be formed with an upper operating mechanism cavity 3 and a lower contact cavity 4 (Figs. 3 and 9) separated by a partition 5 having a central elongated aperture 6 therein.

The complementary housing parts 1 and 2 may be secured together in assembled position by suitable means, for example a rivet 7 extending through the housings 1 and 2 near one end thereof and an annular wire clamp or bail 8 seated in a peripheral groove 8^a in the outer face of the housing 1 and 2 near the other end thereof. The housing parts 1 and 2 may be formed with complementary locating means such as pins 9 and sockets 9^a to insure proper alignment of the parts 1 and 2 when assembled together.

The contacts of the assembled switch are preferably of the direct impinging or abutting type, as distinguished from those which make and break contact by relative sliding movement. The contacts are formed of suitable conducting material such as coin silver and are mounted in the lower contact cavity 4 and comprise a pair of fixed contacts 10 mounted in laterally spaced relationship and an intermediate movable contact 11 (see Figs. 3 and 4). The contacts 10 and 11 are preferably formed of relatively thick and heavy stock, having the capacity to dissipate heat created by any arcing, thus increasing the life and adding to the cooler operation of the switch.

The fixed contacts 10 (see Figs. 20 and 21) each comprise a substantially L-shaped bar adapted to be positioned in complementary recesses 12 molded in the supplementary housing sections 1 and 2 (see Figs. 9, 13 and 14). The fixed contacts 10 have a relatively short arm 13 positioned transversely in the upper portion of the cavity 4 in spaced-apart relation and a substantially longer depending leg portion 14 extending downwardly through the recess 12 and beyond the lower end of the housing members 1 and 2, the terminal ends of said leg portions being suitably formed as by being apertured at 15 to provide wiring terminals for connection with the respective leads of the circuit. The fixed contacts are securely maintained in position in the contact cavity 4 by means of angularly depending fingers 17 struck from the body of the legs 14 and bearing on angularly facing surface 18 in molded housings 1 and 2 (Fig. 13). The faces 18 are preferably inclined transversely as indicated in Figs. 9 and 15, so as to act on the fingers 17 and hold the upper arm portions of the fixed contacts securely in the upper portions of the contact cavity 4.

It will be seen that the lower contact cavity 4 of each housing member comprises an interior chamber connected to the lower end of the housings by means of recesses 12 and an intermediate integral bottom for the cavity 4 having inclined surfaces 18 for cooperative engagement of the fingers 17. Thus the contacts may be inserted in one of the housing members 1 or 2 prior to assembly and are retained in their secured operative position by means of the fingers 17, permitting subsequent assembly with the other housing section therewith.

The provision of a switch having two spaced fixed contacts adapted to be bridged by a movable contact makes for a maximum contact opening or gap, effectively doubling the gap without

4

increasing the motion of the movable contact member of the switch. Such large contact gap is important as it determines the voltage that can be effectively broken. A large contact gap is of extreme importance in aircraft use because the higher the altitude, the less voltage is required for a spark to jump across a gap of predetermined size.

The two fixed contacts are adapted to be bridged by means of a movable contact 11 when it is desired to close the switch, which movable contact is secured to a carrier movable between the ends of the arms 13 of fixed contacts and extending through the aperture 6 into the operating mechanism cavity 3. The movable contact 11 advantageously is a solid and continuous plate-like member having a reduced central portion 20 (see Fig. 18) and terminal portions 21 on opposite sides thereof, each adapted to make contact with its respective fixed contact arm 13.

The movable contact member 11 is moved into and out of contact with the fixed contacts 10 by means of a carrier disposed between and movable in a plane normal to the plane of the fixed contacts. The carrier is preferably of minimum mass and weight so as to avoid as much as possible any tendency of contact bounce upon closing the switch.

In the illustrated embodiment the carrier 22 advantageously is of laminated construction comprising a metal conducting core 27 fitted on opposite sides with insulating sheets 28 (see Fig. 3). The upper portion of the core 27 and insulating sheets 28 which are normally positioned in the operating mechanism cavity 3 are joined by means of a transverse metal eyelet 23 which not only secures the assembled core plate 27 and insulator sheets 28 together but provides a smooth walled opening for the operating spring later to be described. The carrier 22 is reciprocated in longitudinally extending guide channels 29 molded in the interior of the housing members 1 and 2 and opening into the cavities 3 and 4 (see Figs. 3, 9, 11 and 12). The carrier 22 is provided with an elongated opening 22^a near its lower edge in which is movably mounted the contact 11.

The carrier 22 with its associated movable contact 11 is movable longitudinally of the switch into and out of contact with the spaced arms 13 by operating mechanism mounted in the operating mechanism cavity 3. Preferably the carrier is of a size and weight less than the operating mechanism so as to avoid tendency of the contact to bounce upon closing the switch. The cavity 3 of the complementary parts 1 and 2 is formed with an opening 30 for the operating button 31 and an inner enlarged cavity 3 for the operating mechanism, the inner portion of the cavity 3 being of reduced diameter and formed with guide channels 32 for guiding the reciprocable movements of a yoke member 33. The yoke member 33 may be securely connected to the operating button 31 by means of a tubular rivet 34 molded into the button 31 and having an end of the barrel upset over the bridge portion of the yoke as illustrated in Figs. 3 and 4. The tubular rivet 34 in the button 31 provides a housing for a return spring 35 bearing upon the end of the rivet and a disk or plate 36 fixedly mounted in the operating mechanism cavity 3. As previously noted, the upper portion of the cavity 3 is advantageously of larger diameter than the portion containing the guide recesses 32 for the yoke, so as to provide shoulders 37 on which the disk 36 may be supported (see Figs. 3 and 9).

5

The lower ends of the yoke member are intumed to an acute angle to the yoke sides as at 38 and are formed with reduced terminals 39 supporting the ends of an over-center toggle member or spring 40 which passes through the eyelet 23 and serves to make and break the switch with a snap action. The acutely angled intumed yoke ends 38 and the tapered terminals 39 thereof thus provide anti-friction knife-edge support for the ends of the members 40 and thus reduce to a minimum resistance to movement of the member from one over-center position to an opposite position.

The spring 40 may be of any form suitable for the purpose, but preferably is formed of a coiled compression spring of somewhat greater length than the distance between the intumed ends 38 of the yoke member 33, so that it will be bowed in its normal position. The switch, as stated, is normally open or in circuit-broken position, with the movable contact in the lower portion of the cavity and the yoke raised to the upper portion of the cavity 3 by the return spring 35. In this position the intumed ends 38 of the yoke are in place above the center of the eyelet so that the normal position of the spring 40 is concaved. When the circuit is closed, the spring is convexed as shown in Fig. 4.

The spring member 40 thus provides an over-center toggle device, the central portion of which is movable from its dead center compressed position to either the lower concaved position (Fig. 3) or the upper convexed position with a snap action. Thus an exceptionally strong operating force is effective to move the movable contact 11 and its carrier 22 in a direction normal to the plane of the movable and fixed contacts by the spring in compression, when its center is displaced, resulting in remarkably high contact pressure between the contacts 10—11. This permits the switch to carry more current.

The operative connection between the spring 40 and the movable contact carrier 22 is a smooth walled one, as presented by the tubular metal eyelet 23 and preferably has a working fit with the spring without appreciable lost motion. This is highly desirable in installations where the switch is to be closed upon a predetermined movement of the operating mechanism. The design of operating mechanism herein shown insures operation of the switch within $\pm .0002''$ of a predetermined operational point, and when that operational point is reached (about $.0001''$ beyond the dead center of the spring) the movable contact is moved into or out of engagement with the fixed contacts with a swift strong snap action.

With the parts assembled as in Fig. 3 and the switch open or in circuit-broken position, depression of the button 31 acts to lower the operating yoke 33 and the terminal ends of the coil compression spring 40 at the same time compressing the return spring 35. When the ends of the yoke and the connected spring have been moved slightly past the central axis of the eyelet 23 (in the present case in its open position), the spring will snap to a bowed position opposite to that shown in Fig. 3 to a convexed position shown in Fig. 4, thus raising the carrier and movable contact with a snap action. This closes the circuit between arms 13 of the two fixed terminals 10. The switch will remain closed so long as the operating button is held depressed by the operator and, upon release of pressure on the button, the button is returned to its normal raised posi-

6

tion by the action of the spring 35, thus raising the yoke 33. As the ends of the yoke and the coil spring 40 move past the axial center of the eyelet 23 in its raised position as shown in Fig. 4, the spring returns to the position shown in Fig. 3, thus moving the movable contact 11 away from the terminal arms 13 by a snap action.

I prefer to have the contact member 11 so mounted in the carrier that it will make a self-leveiling floating contact with the fixed terminal arms 13—13. This is accomplished by the slightly loose engagement of the notched edges 20 of the contact 11 with the edges of the carrier 22 at the ends of the opening 22^a. This permits the contact 11 to rock or teeter and be self-leveiling to make equal contact under equal pressure with each of the fixed contacts 10 and thus insure a maximum load-carrying capacity of the switch.

Furthermore, the ends 38 of the yoke 33 are preferably inclined so that pivot edges 38^a—38^a are presented to the ends of the spring 40 (Fig. 23). This arrangement permits the spring 40 to move more readily, from one position to the other, than would be the case if wider surfaces were brought to bear against the ends of the spring.

In certain types of switches it is desirable to have an intermediate grounded circuit and this may be simply and advantageously accomplished by my improved switch by merely making the disk 36 in the form of a grounding plate (see Fig. 26). The grounding plate in Fig. 26 comprises a disk-like portion 36^a of a size and shape corresponding to the disk 36 but with a wiring terminal 41 extending therefrom and adapted to be inserted through an opening. This opening may be formed in the side wall of one of the housing sections 1 and 2 wherever convenient so that a wire may be connected thereto. The movable contact is then grounded through the metal carrier plate 22, the eyelet 23, spring 40, yoke 33, tubular rivet 34, spring 35, washer 36^a and wiring terminal 41.

While other forms of spring devices are contemplated within the scope of this invention, I prefer to use a coil over-center spring as this may be passed through a closely fitting aperture and then assembled with the operating yoke arms. Furthermore, such a coiled spring, under compression, exerts a maximum force in a direction normal to the axis thereof, and exerts a greater contact pressure between the movable and fixed contacts, thus enabling the switch to carry heavier electrical loads. It also is effective to eliminate flutter and contact bounce, permitting the movable contact to be supported directly by the carrier.

One of the advantages of the present invention is the provision of a mechanically operable switch mechanism that will be positive in its operation at all times and which will not deteriorate by the action of an electric current flowing through it, as is the case with many existing switches of this type.

Furthermore, the switch of the novel construction and arrangement of parts may be made in very small sizes, for example, with a casing of approximately one-half inch in diameter and less than one inch in length, which will be suitable to handle relatively heavy current loads at high altitudes without arcing. This is of particular advantage in connection with electric switch controls for aircraft.

The present application is a continuation-in-

part of my prior copending application Serial No. 489,841, filed June 5, 1943.

I have chosen to illustrate the principles of my invention in connection with the above illustrated form of switch, but it is understood that the theory of my invention could be applied to devices other than that specifically illustrated and described.

Although I have illustrated and described a preferred form of my invention, I do not wish to be limited thereby because the scope of my invention is best defined by the following claims.

I claim:

1. An electric switch comprising a plurality of spaced fixed contacts, a relatively movable bridging contact adapted for direct impinging face-to-face contact with said fixed contacts, means for moving said movable contact in a direction normal to the plane of the fixed contacts with a snap action between a circuit-making position and a circuit-breaking position comprising a movable contact carrier of less thickness than the spacing between said fixed contacts and movable therebetween and provided with a transverse opening, a helical over-center snap spring extended through said carrier aperture, a yoke bridging one end of the carrier and having arms spaced from opposite sides thereof for moving the opposite ends of said spring in one direction while said carrier is in one of said positions until said spring is moved through an axis of maximum stress whereupon said spring is caused to snap and move said carrier in an opposite direction by a strong snap action to its other selected position, fixed support means disposed between said carrier and yoke and spring means between said support means and yoke for moving the latter in one direction.

2. An electric switch comprising a plurality of spaced fixed contacts, a relatively movable bridging contact adapted for direct impinging face-to-face contact with said fixed contacts, means for moving said movable contact in a direction normal to the plane of the fixed contacts with a snap action between a circuit-making position and a circuit-breaking position comprising a movable contact carrier positioned between the fixed contacts and movable in a direction normal to the plane thereof, said carrier having a transverse opening, a helical over-center spring extended through said carrier aperture, an operating member for the spring including opposed intumed spring end supporting means spaced from opposite sides of said carrier having free pivotal edge contacts with the end convolutions of said spring and restricted blade-like tongues inserted within the coil ends, and means for moving said operating member while said carrier is in one position to move the spring ends through an axis of maximum stress whereupon said spring is caused to snap in an opposite direction and move said carrier and movable contact relative to said fixed contact with a strong snap action, fixed support means disposed between said carrier and yoke and spring means between said support means and yoke for moving the latter in one direction.

3. An electric switch having a plurality of spaced fixed contacts and a movable contact adapted to bridge pairs of said fixed contacts in circuit-closing position, and means for moving said movable contact between circuit-closing and circuit-breaking positions comprising an operating yoke, an over-center coiled spring operatively connected at its ends to said yoke, a movable

contact carrier plate member of substantially less thickness than the length of said spring and disposed between said fixed contacts and normal to the movable contact and spring, said yoke being operable to move the ends of the spring in a direction normal to the plane of said fixed contacts past a dead center position to cause the central portion of the spring to be snapped between oppositely bowed positions and directly transmit to said carrier and movable contact the force of the spring under compression to maintain high pressure engagement between said movable and fixed contacts, said movable contact being freely rockable in said carrier to equalize the contact pressure of said spring between said movable and fixed contacts, fixed abutment means between the carrier and yoke and spring means between said abutment means and yoke for urging said movable contact into one of said positions.

4. An electric switch having a plurality of spaced fixed contacts and a movable contact adapted to bridge pairs of said fixed contacts in circuit-closing position, and means for moving said movable contact between circuit-closing and circuit-breaking positions comprising an operating yoke, an over-center coiled spring operatively connected at its ends to said yoke, a movable contact carrier plate member of substantially less thickness than the length of said spring and disposed between said fixed contacts and normal to the movable contact and spring, said carrier having a transverse spring-receiving aperture having a working fit with said spring, said yoke being operable to move the ends of the spring in a direction normal to the plane of said fixed contacts past a dead center position to cause the central portion of the spring to be snapped between oppositely bowed positions and directly transmit to said carrier and movable contact the force of the spring under compression to maintain high pressure engagement between said movable and fixed contacts, fixed abutment means between the carrier and yoke and spring means between said abutment means and yoke for urging said movable contact into one of said positions.

5. In an electric switch, a pair of fixed contacts mounted in spaced relation, a longitudinally movable carrier for a movable contact disposed between said fixed contacts and movable between preselected switching positions, over-center snap spring means for moving said carrier between said preselected positions and maintaining it stable in one or the other of said positions, said carrier having an aperture extending through it providing aperture walls for surrounding said spring means, said spring means including a transversely deflectable compressive spring whose axis of compression is substantially at right angles to the axis movement of said movable carrier and engageable with the aperture walls of said movable carrier, means for moving said compression element independently of the movement of said carrier through an unstable position of maximum compression whereupon said compression element is caused to snap in an opposite direction and move said carrier with a strong snap action to an opposite preselected switch position, said carrier comprising a core plate of conducting material, insulating plates on opposite sides of said core plate and a tubular metal eyelet extending through all of said plates for securing said plates in assembled relation.

6. In an electric switch, in combination with

a pair of fixed contacts mounted in spaced relation, a movable contact therefor, operating means for said movable contact including a carrier disposed between said fixed contacts and comprising a core plate of conducting material, insulating plates on opposite sides of said core plate providing means for insulating said core from said fixed contacts, and a tubular eyelet extending through all of said plates in assembled relation, and means passing through said eyelet for operating said carrier.

7. In an electric switch, in combination with a pair of fixed contacts mounted in spaced relation, a movable contact therefor, operating means for said movable contact including a carrier disposed between said fixed contacts and comprising a core plate of conducting material, insulating plates on opposite sides of said core plate providing means for insulating said core from said fixed contacts, and a tubular eyelet extending through all of said plates for securing said plates in assembled relation, said eyelet being in electrical contact with said core plate.

8. An electric switch comprising a casing of insulating material formed with an operating mechanism cavity in one end thereof, a plurality of sets of guide grooves extending longitudinally of said cavity, each of said sets defining a plane disposed at right angles to the planes of the other sets, a thin blade-like contact carrier reciprocally mounted in said casing with its opposed side edges disposed in one set of guide grooves, a U-shaped operating yoke having a bridge portion disposed transversely of said carrier and leg portions reciprocally mounted in the other set of guide grooves, an over-center spring member connected at its end portions to the ends of said leg portions and extending through said carrier, fixed support means disposed between the said carrier and yoke and spring means between said support means and yoke for moving the latter in one direction, means for actuating the yoke member to move the ends of said spring past a dead center position of maximum stress to cause said spring to snap in an opposite direction, a fixed contact mounted in said casing and a contact member connected to said carrier and engageable with said fixed contact.

9. An electric switch comprising a casing of insulating material formed with an operating mechanism cavity therein, and a restricted opening in one end of the casing communicating with said cavity, a portion of said cavity being of restricted diameter and formed with a plurality of sets of longitudinal guide grooves, each of said sets defining a plane disposed at right angles to the planes of the other sets, a thin blade-like contact carrier reciprocally mounted in one set of said guide grooves, an operating yoke having a bridge portion extending across said cavity and leg portions mounted in the other set of guide grooves, operative connections between said yoke and carrier, a plunger button secured to said yoke bridge and extending through said restricted casing opening, a disc member mounted in said cavity and supported on the outer end of the restricted portion thereof, and a spring member interposed between said disc and button.

10. An electric switch comprising a casing of insulating material formed with an operating mechanism cavity therein, and a restricted opening in one end of the casing communicating with said cavity, a portion of said cavity being of restricted diameter and formed with a plurality of sets of longitudinal guide grooves, each of

said sets defining a plane disposed at right angles to the planes of the other sets, a thin blade-like contact carrier reciprocally mounted in one set of said guide grooves, an operating yoke having a bridge portion extending across said cavity and leg portions mounted in the other set of guide grooves, operative connections between said yoke and carrier, a plunger button secured to said yoke bridge and extending through said restricted casing opening, a disc member mounted in said cavity and supported on the outer end of the restricted portion thereof, a tubular eyelet embedded in said button and riveted to said yoke bridge and a return spring housed in said eyelet and bearing on said disc.

11. An electric switch comprising a plurality of spaced fixed contacts, a longitudinally movable carrier of less thickness than the spacing between the spaced fixed contacts movable therebetween and in a direction normal to the plane thereof to preselected switching positions and comprising a plurality of insulating plates and a conducting metal core plate, a movable bridging contact mounted adjacent one end of said carrier and adapted to be moved thereby for direct impinging face-to-face contact in circuit-making engagement with said fixed contacts, said carrier provided with a transverse aperture spaced from said movable contact providing opposed spaced bearing faces, an over-center snap spring extended through said carrier aperture and having a working fit with the opposed bearing faces thereof, said movable carrier being of less thickness than the length of said coil spring, an operating yoke for said spring member having spring end supporting pivots normally disposed in a plane between the spring-engaging faces of said carrier aperture, and means for moving said yoke in a direction substantially parallel with said contact carrier to move the ends of said spring in one direction from a bowed condition in which the center portion of the spring has bearing engagement with one face of said carrier aperture through an axis of maximum stress thereof, to cause said spring to snap in the opposite direction into bearing engagement with an opposite face of said carrier aperture and move said carrier and movable contact relative to said fixed contacts with a snap action.

JOHN C. L. SHABECK, JR.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,207,097	Tregoning	Dec. 5, 1916
1,575,179	Olley	Mar. 2, 1926
1,762,075	Petersen	June 3, 1930
1,790,974	Cox	Feb. 3, 1931
1,808,348	Gatzsche	June 2, 1931
2,121,079	Eskin	June 21, 1938
2,125,432	Du Brie	Aug. 2, 1938
2,198,474	Cook	Apr. 23, 1940
2,200,995	Procter	May 14, 1940
2,293,606	Kimbell	Aug. 18, 1942
2,304,808	Draving	Dec. 15, 1942
2,340,615	Rath	Feb. 1, 1944
2,360,128	Hausler	Oct. 10, 1944
2,432,581	Miller	Dec. 16, 1947
2,473,970	Riche	June 21, 1949

FOREIGN PATENTS

Number	Country	Date
333,488	Germany	Feb. 28, 1921