July 6, 1943. J. R. FREI 2,323,389

SWITCH

Filed Oct. 7, 1940

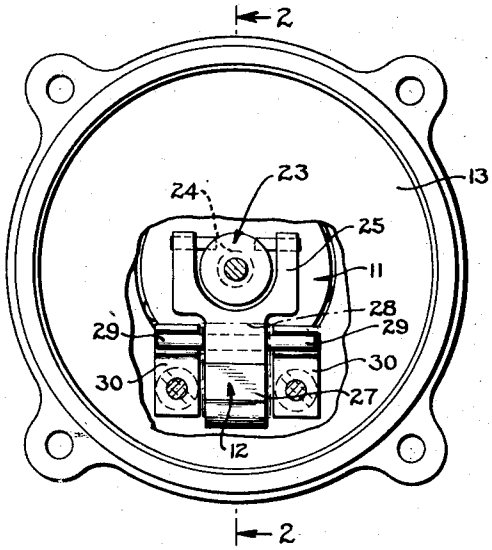


Fig 1

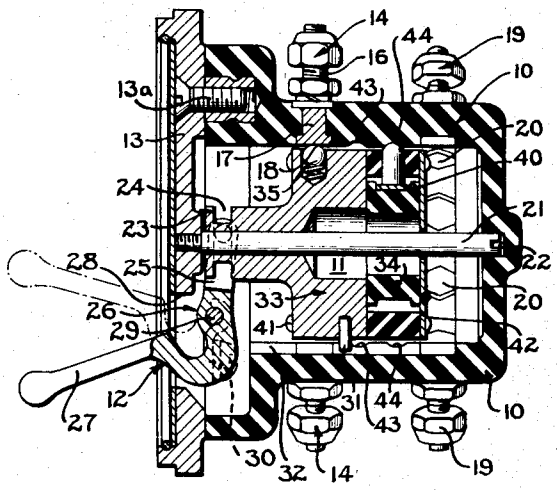


Fig 2

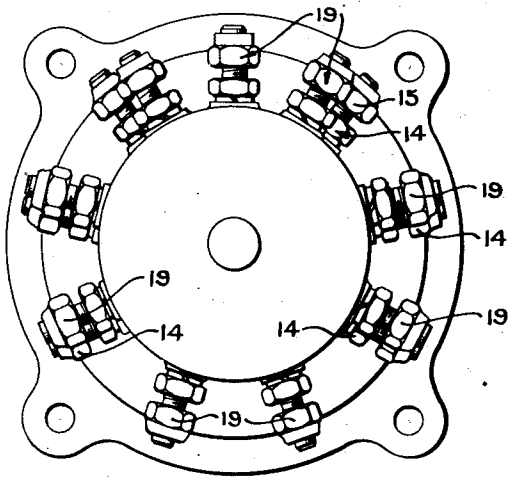


Fig 3

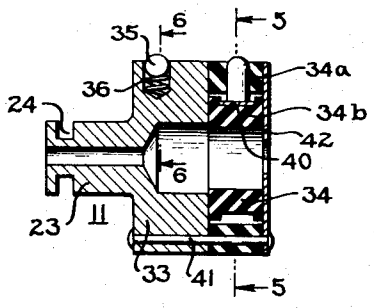


Fig 4

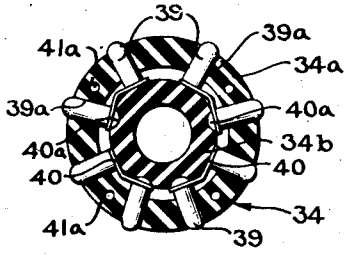


Fig 5

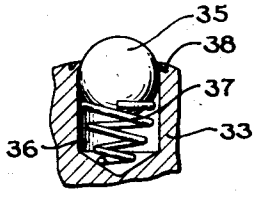


Fig 6

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SWITCH

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14 Claims. (Cl. 200—16)

This invention relates to electrical apparatus, and more particularly to switches of the multiple terminal type.

An object of the present invention is to provide a novel electrical switch of the type adapted to make and/or break a plurality of independent circuits in a predetermined manner.

A further object is to provide a switch of the above type with a novel movable contact member mounted so as to accomplish the several circuit changes with a minimum displacement, producing effective and certain operation with a durable and simple construction.

Still another object is to provide means whereby a plurality of circuits may be simultaneously grounded, the connection to ground being assured by novel contact means.

A still further object is to provide a novel master switch for rendering inoperative the magnetos of a multi-motored plane and other auxiliary electrical apparatus of said plane and motors.

Still another object is to provide a switch having movable contact members with novel means for insuring a good electrical connection between the movable and stationary contacts.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawing. It is to be expressly understood, however, that the drawing is for the purpose of illustration only and is not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawing, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a front view in elevation, with parts broken away, of one form of switch embodying the present invention;

Fig. 2 is a sectional view taken substantially along line 2—2 of Fig. 1;

Fig. 3 is a rear view in elevation of the switch of Figs. 1 and 2;

Fig. 4 is a detail sectional view of the movable contact member of said switch;

Fig. 5 is a section taken substantially along line 5—5 of Fig. 4; and,

Fig. 6 is an enlarged sectional view with parts broken away taken substantially along line 6—6 of Fig. 4.

The present invention embodies in a compact device means for controlling in a novel manner a plurality of independent electrical circuits in a predetermined manner. This is accomplished with a minimum displacement of a novel movable contact member, thereby insuring efficient, quick and certain operation. In the illustrated embodiment, the novel switch means is of a type adapted for breaking a plurality of auxiliary and main motor circuits while simultaneously connecting a plurality of other circuits to a common terminal, such as ground. The device in this form is particularly useful as a master control switch in a multi-motored aircraft in order to break the various light, auxiliary engine and motor circuits while simultaneously connecting terminals of the motor magnetos to ground.

As shown, the novel switch comprises a cylindrical casing 10 of insulating material adapted to carry the stationary contacts, a reciprocable drum 11 constituting the movable contact member and a handle assembly 12 operatively connected to said drum and adapted to actuate the latter, said assembly being pivotally mounted on a cover piece 13 which is rigidly secured to casing 10, preferably by a plurality of counter-sunk screws 13a. A plurality of terminals 14, substantially equally spaced in an annular row about the periphery of casing 10, are rigidly fixed to the latter, said terminals being nine in number when, for example, the switch is adapted for use as a master control on a four-motored aircraft having two magnetos for each motor. Each of said terminals comprises a nut 15, a screw 16, and a stud 17 (Fig. 2) that is preferably integral with said screw and is embedded in casing 10 with a contact surface 18 exposed on and substantially flush with the internal periphery of the casing. A second row of terminals 19 similar to terminals 14 is provided between the latter and the rear of the casing 10, terminals 19 having contact surfaces 20 on the interior of said casing.

The desired connections to terminals 14 and 19 are effected by reciprocal movement of drum 11, which is loosely mounted on a stud shaft or rod 21 that is threaded at one end into cover piece 13 and retained at the other end in an opening 22 provided therefor in the rear end of casing 10. To actuate drum 11, a sleeve 23 rigidly secured thereto is provided with a peripheral groove or slot 24 that is engaged by a bifurcated arm 25. The latter constitutes one arm of a bell crank lever 26, the other arm 27 of which extends through an opening 28 in cover 13 to provide a readily accessible handle, the pivotal movement of which controls the axial position of drum 11 on rod 21. Lever 26 is pivotally mounted on a

pin 29 fixed on opposite sides of opening 28 by means of a pair of brackets 30 (Fig. 1). To restrict drum 11 to reciprocal movement only and to insure proper assembly of the parts, a pin 31 is rigidly attached to said drum and an axially extending slot 32 is provided in casing 10 to be engaged by said pin.

Drum 11 is divided axially into two contact carrying segments 33 and 34 (Fig. 4), and segment 33 which is preferably integral with sleeve 23 is formed from a suitable conducting material, such as brass. A plurality of circumferentially spaced ball contacts 35 are mounted in the rim of segment 33 (Figs. 2, 4 and 6) and project radially therefrom, said contacts being resiliently urged outward. To accomplish this, radial recesses 36 are drilled or otherwise provided in the rim of said segment, said recesses being of a suitable size to receive balls 35 and deep enough to permit a spring 37 to be positioned between each of said balls and the bottom of a recess. To retain balls 35 in position, the upper edge of each recess 36 is preferably peened over, such as by a punching operation, to thereby form a lip 38 (Fig. 6) and hence constrict the mouth of the recess so as to prevent the escape of ball 35. Ball contacts 35 correspond in number to the number of terminals 14 and are circumferentially disposed about segment 33 in corresponding locations to contact surfaces 18 so that every one of the latter surfaces is engaged by one of said contacts when drum 11 is axially disposed so that the row of ball contacts 35 is co-planar with the row of said contact surfaces. The spring associated with the ball contacts serves to provide a good electrical connection between the latter and segment 33 and between said balls and contact surfaces 18 when the latter are engaged thereby.

Contact carrying segment 34 is formed from insulating material and comprises a rigid rim 34*a* and a core 34*b* (Figs. 4 and 5) of suitable resilient material, such as rubberized fabric. A plurality of pin contacts 39 are slidably mounted in radial openings 39*a* provided in rim 34*a*, and core 34*b* bears against said pins and tends to yieldably press the latter radially outward. Pairs of adjacent contacts 39 are electrically connected to each other by means of conducting strips 40 which are interposed between rim 34*a* and core 34*b*, each of said connected pairs of contacts 39 being insulated from the other contacts. It is preferable, in order to prevent shifting of strips 40 and for facilitating assembly, to have each of said strips rigidly attached, as at 40*a*, to at least one of the two contacts which are electrically connected thereby, and to bend said strip slightly to cause it to conform more closely to the shape of the interior of rim 34*a*. Block 34*b* is preferably provided with a centrally disposed peripheral groove and the periphery within the groove is octagonal to accommodate the bent strips 40. Contacts 39 are so positioned in relation to drum 11 that each engages a predetermined one of contact surfaces 20 when said drum is moved to cause the row of terminals 19 to be co-planar with the row of said contacts, said terminals being thus connected to each other in pairs.

Segments 33 and 34 are secured to each other, preferably by a plurality of rivet-like members 41 (Figs. 2 and 4) which extend axially through said segments and through a plate 42 which may be provided at the rear of segment 34 for the purpose of fixing core 34*a* in relation to rim 34*b*. The elements held together by members 41 are preferably bored to receive said members and the openings 41*a* (Fig. 5) thus provided are unequally spaced circumferentially in order to obviate the possibility of an improper assembly of the parts. A pair of peripheral grooves 43 and 44 are preferably provided on the interior of casing 10 to be engaged by balls 35 and pins 39, respectively, and to thereby predetermine two positions for drum 11. Groove 44 is suitably located so that when pins 39 engage said groove, as shown in Fig. 2, each of contacts surfaces 18 and, therefore, terminals 14 becomes electrically connected to one of said ball contacts and to segment 33. The distance between contacts 35 and contacts 39 in relation to the distance between the rows of terminals 14 and 19 is such that when groove 44 determines the position of drum 11, contacts 39 are disconnected from contact surfaces 20 of terminals 19. On the other hand, when groove 43 determines the position of said drum, i. e., when balls 35 engage the latter groove, said balls are disconnected from terminals 14 while pin contacts 39 become connected to terminals 19.

When the above switch mechanism operates as the master switch in a four-motored airplane, eight of terminals 14 are connected by suitable leads (not shown) to the ground terminals of the eight magnetos of the main engines and the ninth terminal is grounded. Accordingly, when said terminals become electrically connected to segment 33 by means of contacts 35, each of the magnetos is grounded by a plurality of circuits, one of the latter consisting of the grounded terminal 14 while others include arm 25 and shaft 21. Various auxiliary motor and light circuits, for example, are simultaneously controlled by the switch by being connected in series with the pairs of normally connected terminals 19. When the switch is in "off" position, the magnetos are grounded, as above described, and each of the auxiliary circuits is broken since the pairs of terminals 19 are disconnected by the displacement of pin contacts 39. When the switch is snapped into "on" position, the ground connection is broken by disengagement of balls 35 and contact surfaces 18 to thereby render the main engine magnetos operative and the auxiliary circuits are rendered operative by the connection of pin contacts 39 with terminals 19.

If it is desired to radio-shield the above-described mechanism, it is only necessary to attach to the rear of cover 13 a cup-shaped metallic casing having a suitable outlet for the cables attached to terminals 14 and 19.

There is thus provided a novel master switch adapted to control a plurality of circuits in a predetermined manner, the same being effective, for example, to connect a plurality of independent terminals to a single common terminal while simultaneously breaking a plurality of power circuits. The switch comprises novel contact means capable of achieving desired circuit changes with a minimum displacement and having means incorporated therewith for insuring a good electrical connection between the movable and stationary contacts. Additionally, the novel switch mechanism comprehended renders it possible to render the entire electrical and ignition systems of an aircraft inoperative with a short movement of a single control lever. The structure of the switch is compact and durable and permits of ready assembly.

Although only a single embodiment of the present invention has been illustrated and de-

scribed, it is to be expressly understood that the same is not limited thereto. For example, it will now be apparent to those skilled in the art that the novel switch means can be adapted for simultaneously breaking and making all the circuits connected therethrough by spacing the rows of movable contacts a distance equal to the spacing of the stationary contacts. Various other changes may be made in the design and arrangement of parts without departing from the spirit and scope of the invention. For a definition of the invention, reference will be primarily had to the appended claims.

What is claimed is:

1. In a master switch mechanism, two rows of stationary terminals, mounting means therefor, movable mechanism comprising an insulated section and a conducting section, two sets of contact members, one of said sets being mounted in each of said sections, yielding means for urging said contact members in the direction of said terminals, means carried by said insulating section adapted to electrically connect the contact members carried thereby in pairs, and actuating means for operating said movable mechanism to cause the terminals of one of said rows to become electrically connected to the contact members of one of said sets.

2. In a master switch mechanism, two rows of stationary terminals, mounting means therefor, movable mechanism comprising an insulated section and a conducting section, two sets of contact members, one of said sets being mounted in each of said sections, yielding means for urging said contact members in the direction of said terminals, means carried by said insulating section adapted to connect the contact members carried thereby in pairs, actuating means for operating said movable mechanism to cause the terminals of one of said rows to become electrically connected to the contact members of one of said sets, and means for grounding said conducting section.

3. In a master switch, two rows of stationary terminals, insulated hollow supporting means for said terminals, mechanism mounted for reciprocal movement in said supporting means, said mechanism comprising an insulated segment and a conducting segment, two sets of contact members mounted in the rim of said mechanism and projecting radially therefrom, one of said sets being carried by said insulating segment and the other set by said conducting segment, conducting means resiliently urging the contact members in said conducting segment radially outward, an insulator yieldingly urging the contact members in said insulated segment radially outward, means adapted to connect the contact members carried by said insulated segment in pairs, and actuating means for operating said movable mechanism to cause the terminals of one of said rows to become electrically connected to the contact members of one of said sets.

4. In a master switch, two rows of stationary terminals, insulated hollow supporting means for said terminals, mechanism mounted for reciprocal movement in said supporting means, said mechanism comprising an insulated segment and a conducting segment, two sets of contact members mounted in the rim of said mechanism and projecting radially therefrom, one of said sets being carried by said insulating segment and the other set by said conducting segment, conducting means resiliently urging the contact members in said conducting segment radially outward, an insulator yieldingly urging the contact members in said insulated segment radially outward, means adapted to connect the contact members carried by said insulated segment in pairs, and actuating means for operating said movable mechanism to cause the terminals of one of said rows to become electrically connected to the contact members of one of said sets, said last-named means serving to ground said conducting segment.

5. In a multiple circuit switch, a casing, two rows of terminals secured in said casing, two rows of contact members, conducting means for mounting one of said rows of contact members, insulating means for mounting the other row of said contact members, means connecting said conducting means to ground, means electrically connecting pairs of the contacts mounted in said insulator, apparatus for moving said conducting and insulating means in unison, and means for predetermining two positions to which said apparatus is adapted to move said insulating and conducting means, the terminals of one row being connected to the contact members of the insulating means in the first of said positions and the terminals of the other row being connected to the contact members of the conducting means in the second of said positions.

6. In a master switch, a casing of insulating material, a plurality of terminals secured in said casing and extending therethrough to provide contact surfaces on the interior of said casing, said terminals being located in two axially spaced rows, a drum mounted in said casing and adapted for reciprocable movement relative thereto, said drum comprising an insulated section and a conducting section, a set of contacts mounted in said conducting section and adapted to engage a row of said contact surfaces to connect a row of said terminals to said conducting section, means for grounding said conducting section, a set of contacts carried by said insulated section, said last-named contacts being connected in pairs and adapted to engage the other row of contact surfaces to complete circuits between pairs of terminals of said row, and means for actuating said drum to cause one of said sets of contacts to be electrically connected to its corresponding row of terminals.

7. Apparatus of the class described comprising a housing including a cup-like member of insulating material and a cover removably secured to said member, a supporting rod extending coaxially of said housing between said cover and the end wall of said member, a plurality of contact terminals in the wall of said member, means carrying a plurality of contact elements slidably mounted on said rod, and means for reciprocating said contact carrying means to move said elements into and out of electrical engagement with said terminals, said last-named means including a bell crank lever pivotally mounted on said cover and having sliding engagement with the walls of a groove in said contact carrying means.

8. Apparatus of the class described comprising a cylinder-like housing, a supporting rod extending coaxially of said housing between the ends thereof, means carrying contact elements slidably mounted on said rod, means for preventing angular movement of said contact carrying means relative to said housing, a plurality of terminals circumferentially spaced around the wall of said housing, and means pivotally mounted on an end wall of said housing for reciprocat-

ing said contact carrying means on said rod to move said contact elements into and out of electrical engagement with said terminals, the pivotal axis of said pivotally mounted means being at right angles to and spaced from said rod and said pivotally mounted means having a portion slidably engaging the walls of a groove in said first-named means.

9. In a switch mechanism, a hollow casing, a plurality of contact terminals mounted in the wall of said casing, and contact carrying means in said casing comprising a supporting member, a ring of insulating material, a plate extending across an open side of said ring, a resilient core member in said ring interposed between said supporting member and said plate, means securing said plate, ring and supporting member in assembled relation, a plurality of contact members slidably extending through radial openings in said ring and held by said core member in yielding engagement with the wall of said casing for electrical engagement with said terminals and means electrically connecting the inner ends of adjacent ones of said contact members.

10. In a switch mechanism, a hollow casing, a plurality of terminals mounted in the wall of said casing, contact carrying means slidably mounted in said casing, a plurality of contacts on said contact carrying means adapted to engage said terminals, and means for reciprocating said contact carrying means to move said contacts into and out of electrical engagement with said terminals, said last-named means comprising a bell crank lever pivotally mounted on said casing, the pivotal axis for said lever being perpendicular to the direction of movement of said contact carrying means and said lever having sliding engagement with the walls of a groove in said contact carrying means.

11. In a switch mechanism, a hollow casing, a plurality of terminals mounted in the wall of said casing, contact carrying means in said casing comprising a ring of insulating material, a resilient core member in said ring, a plurality of contact members slidably extending through radial openings in said ring and held by said core member in yielding engagement with the wall of said casing for electrical engagement with said terminals and means electrically connecting the inner ends of adjacent ones of said contact members, means slidably supporting said contact carrying means in said casing, and means comprising a lever pivotally mounted on said casing for moving said contact carrying means to move said contact members into and out of engagement with said terminals.

12. In a switch mechanism, a cylinder-like casing, a plurality of circularly disposed terminals in the wall of said casing, movable contact means in said casing comprising an insulating ring, a plurality of contact elements slidably extending through radial openings in said ring, common means for resiliently pressing said contact elements against the inner wall of said casing and means electrically connecting the inner ends of selected pairs of said contact elements including a resilient metallic strap mechanically connected to one element of each pair and engaging the peripheral surface of said common means, and means for moving said contact carrying means axially of said casing to move said contact elements into and out of engagement with said terminals.

13. In a switch mechanism, a casing, contact carrying means slidably mounted in said casing, a first set of circumferentially spaced and electrically connected contacts on said means, means for yieldingly holding said contacts against the wall of said casing, a first set of terminals mounted in the wall of said casing for electrical engagement by said contacts, a second set of circumferentially spaced contacts on said contact carrying means, means electrically connecting the contacts of said second set in pairs, means for yieldably holding the contacts of said second set against the wall of said casing, a second set of terminals mounted in the wall of said casing for electrical engagement by said second set of contacts, and means for moving said contact carrying means axially of said casing, said contacts and terminals being so positioned that said first sets are in electrical engagement when said second sets are out of electrical engagement and said second sets are in electrical engagement when said first sets are out of electrical engagement.

14. In a switch mechanism, a hollow casing, means including a member of electrical insulating material mounted in the casing for reciprocation therein, a plurality of electrical conductors slidably extending through radial openings in said member at the periphery thereof, resilient insulating means for yieldably pressing said conductors against the inner wall of said casing, and means for electrically connecting the inner ends of certain of said conductors, said last-named means including a plurality of bendable metallic straps engaging the peripheral surface of said resilient insulating means, each of said straps being mechanically and electrically connected to at least one of said conductors and electrically connected to at least one other of said conductors.

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