Sept. 4, 1956 R. W. KISHBAUGH ET AL 2,761,923

ELECTRICAL SWITCH

Filed April 20, 1951 3 Sheets-Sheet 1

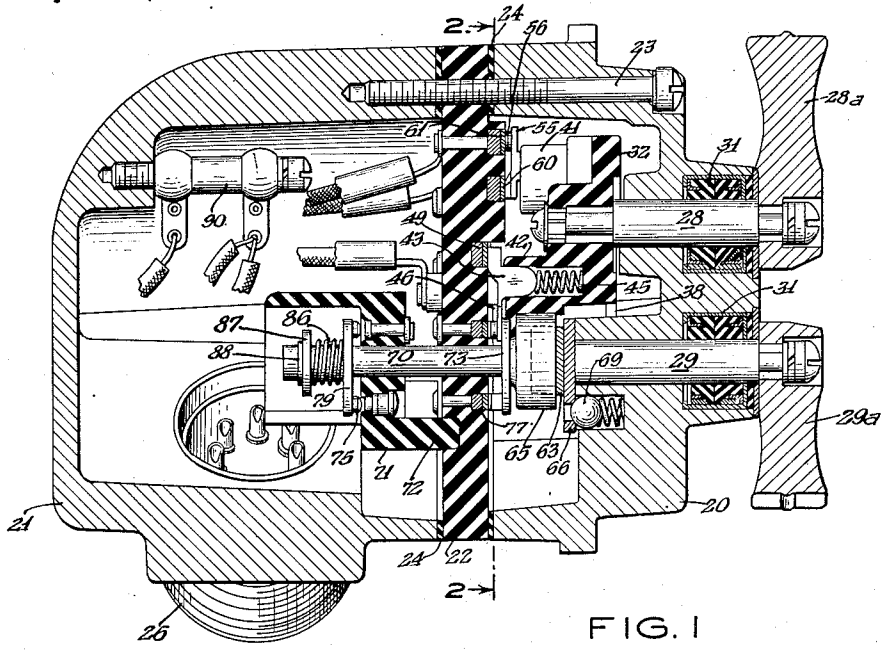


FIG. 1

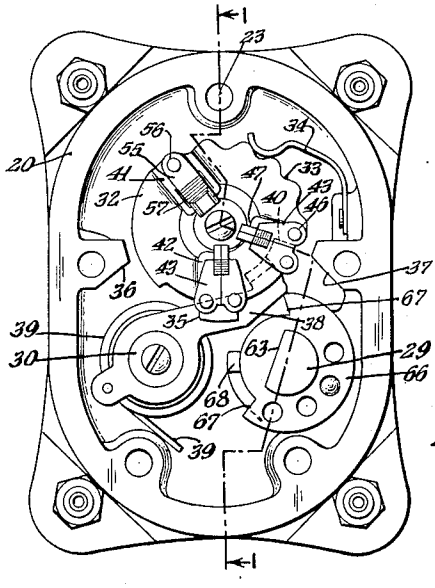


FIG. 2.

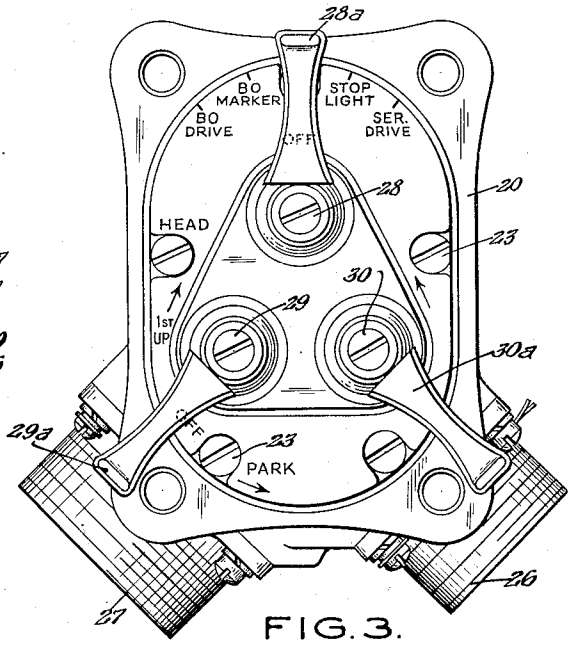


FIG. 3.

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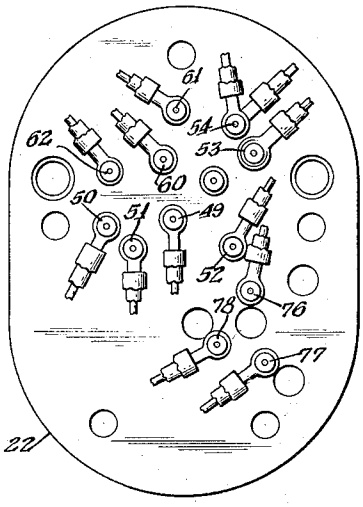


FIG. 4.

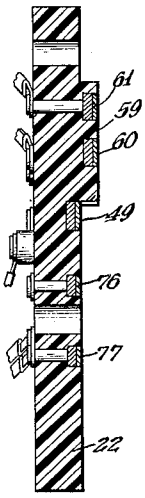


FIG. 5.

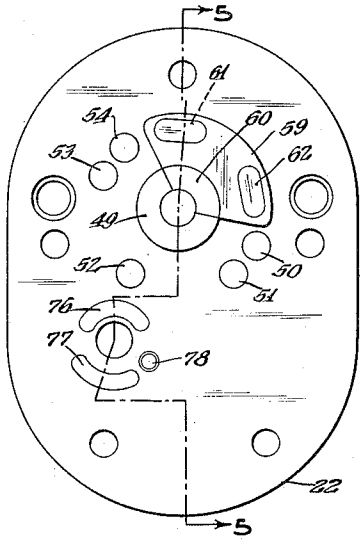


FIG. 6.

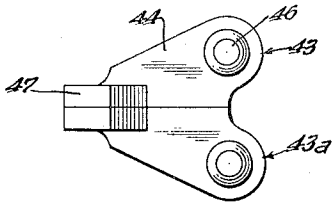


FIG. 7.

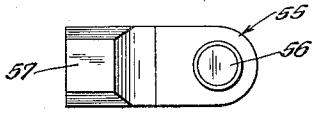


FIG. 10.

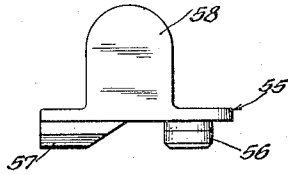


FIG. 11.

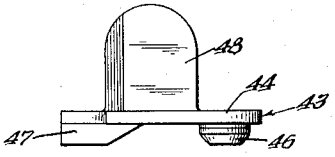


FIG. 8.

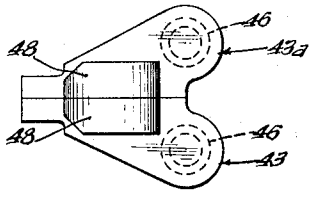


FIG. 9.

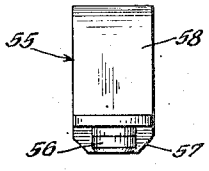


FIG. 12.

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ELECTRICAL SWITCH

Filed April 20, 1951 3 Sheets-Sheet 3

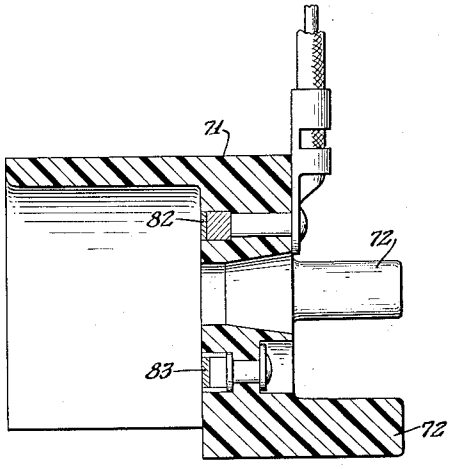


FIG.13.

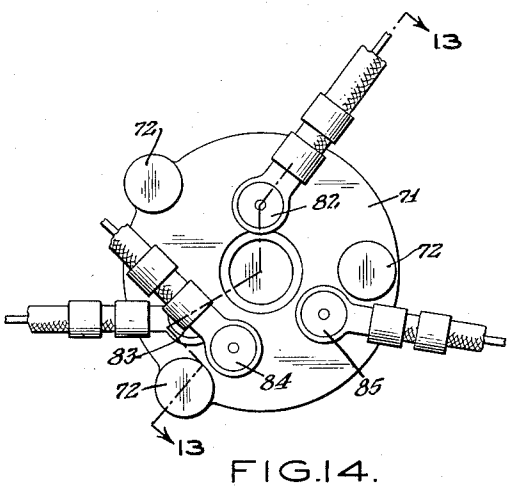


FIG.14.

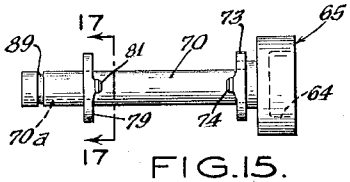


FIG.15.

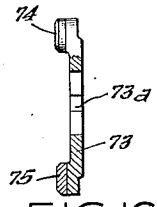


FIG.16.

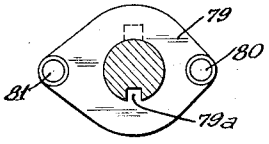


FIG.17.

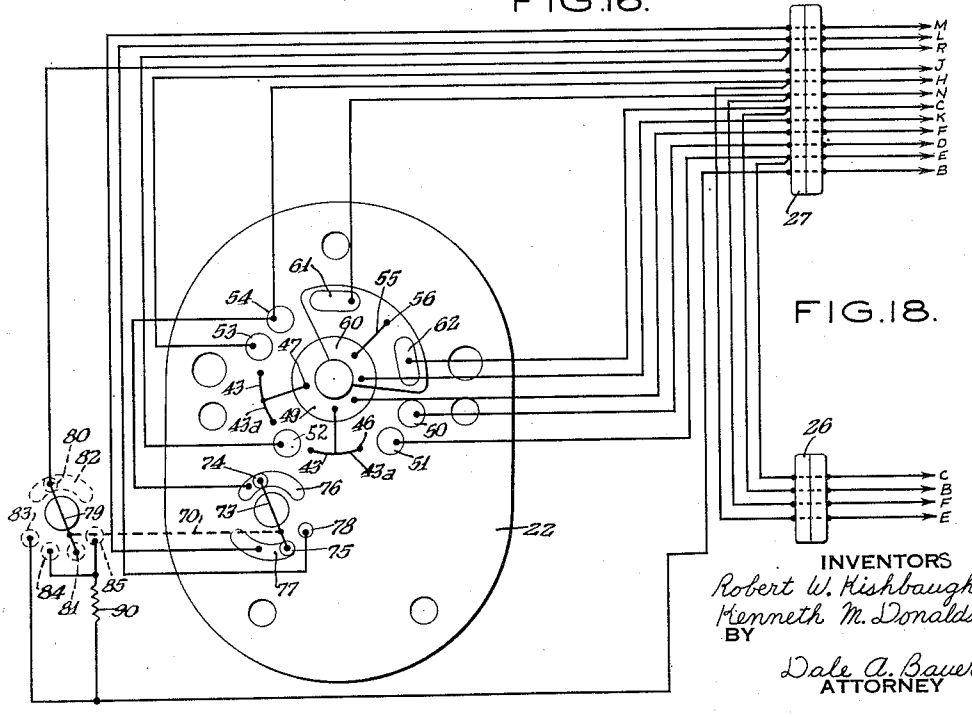


FIG.18.

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United States Patent Office 2,761,923 Patented Sept. 4, 1956

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ELECTRICAL SWITCH

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Application April 20, 1951, Serial No. 222,138

14 Claims. (Cl. 200—5)

This invention relates to electrical apparatus and more particularly to switch means for controlling the flow of electrical energy through electrical circuits.

One of the objects of the present invention is to provide novel switch means adapted for selectively connecting a plurality of lighting circuits or the like to a source of relatively low voltage electrical energy.

Another object is to provide novelly constructed switch means adapted for use in controlling the lighting circuits for military vehicles or the like the same being so constructed and arranged guard against human error which might result in improper inadvertent operation of the lighting circuits in a manner which would result in apprising the enemy of a secret position.

Still another object is to provide novel electrical switch means which may be used to effect control of a plurality of circuits in a variety of combinations.

A further object is to provide switch means which are novelly constructed in such a way as to take best and most efficient advantage of a small space.

A still further object is to provide novel contact means and novel mounting means therefor in electrical apparatus such as a switch.

Still another object is to provide electrical switch means which is virtually water-tight and therefor adapted for use on amphibious and marine vehicles and in locations where the same may be subjected to driving rain and the like.

The above and further objects and novel features of the invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

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

Fig. 1 is a sectional side elevation of one form of switch means embodying the invention, the section being taken approximately along line 1—1 of Fig. 2;

Fig. 2 is an end view looking from the left toward the right in Fig. 1 along the line 2—2 and with the rear cover of the casting and partition removed;

Fig. 3 is a front end view of the switch means of Fig. 1;

Figs. 4, 5 and 6 are rear side sectional and front views, respectively, of the contact carrying partition, the section of Fig. 5 being taken substantially on line 5—5 of Fig. 6;

Figs. 7, 8 and 9 are enlarged rear, side and front detail views of a novel form of double contact unit comprehended by the invention;

Figs. 10, 11 and 12 are enlarged rear, side and radial views of a single rotor contact or bridge;

Fig. 13 is an enlarged sectional detail view of a contact and rotor support, the section being taken on line 13—13 of Fig. 14;

Fig. 14 is a front end view of the support member of Fig. 13;

Fig. 15 is a detail side elevation of one of the switch

rotors with the contact carrying members which move angularly therewith;

Fig. 16 is a detail view, partly in section, of one of said contact carrying members;

Fig. 17 is an end view of the other of said contact carrying members, the view being taken along line 17—17 of Fig. 15; and,

Fig. 18 is a diagrammatic wiring diagram illustrating one manner of connecting a plurality of lighting circuits or the like for control by the switch mechanism of Figs. 1 to 17 inclusive.

The single embodiment of the invention illustrated in the drawings, by way of example, is in the form of a moisture-tight switch mechanism adapted for use on military trucks and the like for controlling the lighting circuits thereof, the same being novelly constructed to guard against improper operations during so-called blackout operation of the vehicle. In the form illustrated, said switch means comprises a housing which includes a front section 20, a rear section 21 and a partition 22 interposed between said sections. These casing or housing elements are secured together by means of a plurality of bolts 23 and suitable gaskets 24 may be interposed between partition 22 and each of the sections 20 and 21 to provide a moisture-tight joint. Rear section 21 may be provided with the required cable outlets in the form of moisture-tight plug and socket connector receptacles, two plural contact recetacles 26 and 27 being shown by way of example. Front section 20 rotatably supports three rotor shafts 28, 29 and 30 which terminate at the front of the casing in operating handles 28*a*, 29*a* and 30*a*, respectively. A seal 31 is provided around each of said shafts to prevent the entrance of moisture therealong. As will more fully appear hereinafter, handles 28*a* and 29*a* are associated with contact carrying switch rotors whereas handle 30*a* is associated with locking means for one of said rotors.

The novel switch or circuit control means associated with handle 28*a* comprises a rotor body 32 of insulating material mounted on the inner end of shaft 28 for limited rotary or angular movement therewith. At the front or right hand peripheral edge thereof, as viewed in Fig. 1, rotor 32 is provided with five or other suitable numbers of arcuate notches 33 (Fig. 2) with which a leaf spring 34, anchored at one end on the casing section 20, cooperates to yieldably hold the rotor in selected position. At the left or rear end of rotor 32 there is provided a radial extension 35 which is adapted to engage stops 36 and 37 on casing section 20 to limit the angular movement of the rotor.

Releasable locking means are also provided for positively preventing movement of rotor 32 out of selected positions without first deliberately releasing said locking means. The latter, as shown, comprises a locking pawl 38 mounted on the inner end of shaft 30 for rotary movement therewith. Said pawl is biased in a counterclockwise direction, as viewed in Fig. 2, by a coil spring 39, one end thereof being connected to the pawl and the other end being biased against the casing section 20. The free, hooked end of pawl 38 is adapted to extend into a notch 40 (dotted lines in Fig. 2) in the front edge of rotor 32 to limit the movement of the latter. When pawl 38 is actuated to non-locking position by handle 30*a*, rotor 32 may be angularly moved to the full extent permitted by stop means 35, 36, 37. When rotor 32 has been moved to a position in which the pawl 38 will not engage notch 40 the free end of the pawl will ride on the smooth periphery of the rotor and will not therefore impede the movement thereof until the pawl end again drops into the notch 40.

Novel contact or circuit bridging means are mounted in a novel manner in the rotor 32 for selective engage-

ment with electrical contact surfaces which are substantially flush with the front face of partition **22** and connected with terminals at the rear face of the partition. In order to prevent flashovers between contacts of different circuits and yet conserve space the rotor **32** has two rearwardly-extending, eccentrically-disposed projections **41** and **42** for carrying contact members or brackets for bridging contact surfaces some of which are at different levels than others on the face of partition **22**.

The longer projection **42** carries two pairs of contact brackets **43**, **43***a* which are shown in detail in Figs. 7 to 9 and in operating position in Figs. 1 and 2. Each bracket or bridge of a pair comprises a plate-like portion **44** on one face of which there is mounted a contact **46** and an integral raised contact surface **47**. Extending from the other face of plate portion **44** is a leg **48** which preferably has an arcuate end surface. Brackets **43** and **43***a* of a pair are of the same construction except that the positions of the parts are reversed so that the same may be mounted with flat sides thereof in engagement as illustrated in Fig. 7. The adjacent legs **48** of a pair of brackets **43**, **43***a* are shaped to slidably fit into an axially extending recess in projection **42** with the flat engaging surfaces of the same extending radially from the axis of rotation of the rotor and the contacts **47** radially innermost. A coil spring **45** in said recess urges both contact brackets **43**, **43***a* toward partition **22** with contacts **46** and **47** in sliding engagement therewith and with contact surfaces thereon. The contact surfaces **47** of all four brackets **43**, **43***a* are adapted to yieldably and continuously engage an arcuate bar **49** (Fig. 6) whereas contacts **46** move into selective engagement with circularly arranged contacts **50**, **51**, **52**, **53**, and **54** as the angular position of rotor **32** is changed (Figs. 6 and 18). This construction of the contact bridges insures firm contact by both bridges of each pair and prevents possible severance of the bridge by burning in the event of a short circuit.

The shorter projection **41** on rotor **32** carries a single contact bracket or bridge **55** which carries contact **56** and raised contact surface **57** on the outer face thereof and a leg **58** on the opposite face (Figs. 10 to 12). Leg **58** is slidably received in a recess in rotor extension **41** and urged outwardly by a spring (not shown) in the same manner as the pair of brackets **43**, **43***a*. Thus contact **56** and contact surface **57** are yieldably held against the face of a segmental raised area **59** on partition **22**. The raised contact surface **57** rides on an arcuate segment **60** and contact **56** is adapted to be selectively engaged with contacts **61** and **62** upon actuation of rotor **32**. It will be noted that the corresponding ends of arcuate bars **49** and **60** are in the same radial planes but are separated by being on different levels so that no arcing takes place therebetween.

Electrically associated with the switch means embodying rotor **32** and novelly mounted in housing **20**, **21**, **22** are other novelly constructed auxiliary switch means adapted for actuation by shaft **29** and handle **29***a*. For this purpose, the enlarged inner end of shaft **29** has a flat **63** on one side (Fig. 2) that extends into a correspondingly shaped recess **64** in a switch rotor **65** when the elements of the entire structure are in assembled relation. A flange or disk **66** (Fig. 2) is provided on shaft **29** for rotation therewith adjacent the inner wall of casing section **20**, said disk having a portion at the periphery thereof cut away to form radial stops **67**, **67** for engagement with a stop **68** on casing section **20** to limit the angular movement of shaft **29** and rotor **65**. A plurality of holes are formed in disk **66** for engagement by a spring pressed ball **69** to yieldably hold the rotor and shaft in a plurality of selected positions.

Rotor **65** is made of insulating or non-conductive material and has a shaft or spindle portion **70** which extends through and is rotatably journalled in partition **22**. Rotor shaft **70** is also journalled in a support **71** mounted on partition **22** within casing member **21** by means of a plurality of legs or extensions **72**, three of which are shown. The legs **72** fit loosely into recesses in the rear face of partition **22** and are yieldably held therein by novel means in a manner to hereinafter appear.

An electrically conductive contact plate or bridge **73** is mounted on rotor **65**, **70** for rotation therewith and has diametrically disposed contacts **74** and **75** thereon, the former having continuous engagement with arcuate contact **76** and the latter being adapted to selectively engage contacts **77** and **78** in the front face of partition **22**. A circuit may thus be closed between contacts **76** and **77** or between contacts **76** and **78**. Also mounted on rotor shaft **70** for rotation therewith and engagement with the rear face of support **71** is a second electrically conductive contact plate or bridge **79**. The latter carries diametrically disposed contact points **80** and **81**, the first of which engages an arcuate bar **82** and the latter of which selectively engages contacts **83**, **84** and **85** in the rear face of support **71**. Contact plate **73** is shown as having a key-way **73***a* cooperating with a lug or key on shaft **70** and contact plate **79** has a key **79***a* which enters a key-way **70***a* in the shaft so that the shaft and the two plates will rotate together.

The parts of the last described auxiliary switch mechanism are yieldably held in assembled relation on partition **22** by a coil spring **86** surrounding shaft **70** and interposed under compression between contact plate **79** and a washer **87** which is held against removal from the shaft by a snap ring or key **88** that engages annular groove **89** in the shaft. Spring **86** functions to yieldably press contact plates **73** and **79** in opposite directions into operative positions to hold rotor **65**, **70** and support **71**, **72** in assembled positions on partition **22**.

The various contacts which are embedded in the front face of partition **22** and the rear face of support **71** have terminals which extend through said partition and said support for connection to electrical leads, only a few of which are shown except in Fig. 18. In view of the simplicity of the casing construction and the ease with which the same may be assembled after the different sub-assemblies have been completed, the terminal ends of the stationary contacts may be peened over or riveted to secure the same in place and the terminal ends of the leads may be electrically and mechanically secured thereto in the same operation, i. e. by catching the lead terminals between the head or turned over portion of the rivet or terminal and the partition or support, as the case may be. When so constructed the switch may be disassembled for inspection and repair with utmost facility.

When the specific switch mechanism herein illustrated and described is used for the lighting circuits of a military vehicle, such as a truck pulling a trailer, the circuits may be arranged as shown in Fig. 18 wherein the parts are illustrated diagrammatically with both the main and auxiliary switches in "Off" position. The outgoing cables from receptacle **27** may be connected as follows:

M—Service head lamps
L—Parking lamps
R—Feed to stop lamp switch
J—Feed to service turn indicator switch
H—Service tail lamp, service clearance lamps
N—Blackout stop lamp
C—Service stop lamp
K—Stop lamp switch (dead side)
F—Battery
D—Blackout driving lamp
E—Blackout clearance lamps, blackout trail lamp, feed to blackout turn indicator switch, blackout marker lamps
B—Panel lamps

The outgoing cables from connector receptacle **26** may be connected as follows:

C—Blackout marker lamps, blackout tail lamps, and blackout clearance lamps
B—Service stop lamp
F—Blackout stop lamp
E—Service tail lamp and service clearance lamps.

As indicated on the face of housing section **20**, main switch handle **28***a* has five selective positions, i. e., "Off" (the illustrated position), "B. O. (Blackout) Marker," "B. O. Drive," "Stop Light" and "Service Drive" positions. These positions are located by spring **34** and notches **33** on rotor **32**. A different set of lighting conditions is obtained in each main switch position. Handle **28***a* may be moved at any time between "Off" and "B. O. Marker" positions, but in order to move the same from either of these two positions, to either of the other three positions, handle **30***a* must be moved counter-clockwise (Fig. 3) to release the locking pawl **38**. Handle **29***a* is free at all times to be moved to any of its four positions determined by the ball **69** and the holes in disk **66**, the positions being indicated by the legends "Off," "Park," "1st-Up" and "Head." From the illustrated diagram it will be seen that when the main switch handle **28***a* is in "Off" position, all circuits are open irrespective of the position of the auxiliary switch handle **29***a*. When the main switch is in "B. O. Marker" or "B. O. Drive" position, the auxiliary switch may be actuated to effect either bright or dim panel lights, the dim lighting of the panel light being effected through a resistor **90** when handle **29***a* is in "Park" or "1st-Up" position. When the main switch is in "Stop Light" position, the auxiliary switch can be moved to effect dim or bright operation of the panel lights. When the main switch is in "Service Drive" position, the auxiliary switch may be moved to effect the lighting of the parking lights plus dim panel lights, or the lighting of the head lights with off, dim, or bright panel lights. There is thus provided a wide variety of lighting conditions controlled by a very simple and small switch mechanism for vehicle operation or parking under service and blackout conditions.

There is thus comprehended novel electrical switch mechanisms which may be designed and combined to provide a wide selective control of a plurality of electrical circuits, such as the lighting circuits of military vehicles that are equipped with different sets of lights for operation and parking under blackout conditions as well as ordinary service conditions. Considering the type and variety of the circuits controlled the novel construction provided requires a comparably small space and a comparably small number of parts. The simplification of the construction of the mechanism provided reduces the probability of failures in operation as well as the manufacturing time and cost and greatly facilitates the repair and replacement of parts. The mechanism also embodies novel switch means which in turn includes novel means for effecting by a movable contact or bridge the selective closing of a plurality of circuits. The novel construction of said contact bridge is such that two units may be mounted side-by-side to conserve space and in such manner that one functions relatively independently of the other, thereby insuring that any tilting of one contact bridge will not affect the proper operation of the other.

Although only one embodiment of the invention is illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that the same is not limited thereto or to the specific use thereof in connection with the lighting circuits of a motor vehicle or the like. For example, the "so-called" partition **22** need not be solid since it is not necessary that the same function as a partition. Likewise the positioning and arrangement of the contacts within the switch mechanism as well as the number and shapes of said contacts may be varied for different installations. Although the connector receptacles **26** and **27** may be of any suitable known construction, water-tightness of the switch mechanism is best assured and assembly and disassembly of

the construction is facilitated if these connectors are the type which embody removable rubber-like inserts for removably supporting the contact pins or sockets which are connected to the ends of the cables which emerge from the casing. Various changes in addition to those mentioned above and particularly changes in the design and arrangement of the parts illustrated and in the materials suggested may be made without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art.

What is claimed is:

1. In apparatus of the class described, a housing comprising a front section, a rear section and a contact supporting panel interposed between said sections, a main switch mechanism comprising a first set of spaced contacts mounted on said panel, a rotor journalled in said front section and bridging means carried by said rotor for selectively connecting contacts of said first set, auxiliary switch mechanism comprising a second set of spaced contacts on said panel, a second rotor journalled in said panel and a bridging member carried by said second rotor for selectively connecting contacts of said second set, means journalled in said front section for imparting angular movement to said second rotor, and means for electrically connecting contacts of said first and second sets.

2. Apparatus as defined in claim 1 wherein said auxiliary switch mechanism includes a support mounted on said panel and having a wall in spaced relation to said panel, a third set of spaced contacts on the face of said wall remote from said panel, and another bridging member carried by said second rotor for selectively connecting contacts of said third set.

3. Apparatus as defined in claim 2 comprising unitary resilient means on said second-named rotor for yieldably urging both said bridging members into operative position.

4. Apparatus as defined in claim 1 wherein the rotor of the main switch has a recess therein and said bridging means includes a T-shaped bridge of electrically conductive material comprising a solid leg portion slidably extending into said recess, a plate-like cross piece at the outer end of the leg portion and a raised contact surface at each end of said cross piece on the face thereof opposite said leg portion, and resilient means in said recess for urging said bridge outwardly.

5. Apparatus as defined in claim 1 wherein said bridging member surrounds and is keyed to said second rotor for rotation therewith and has radially extending portions with contact surfaces thereon.

6. In apparatus of the class described, a housing comprising a front section, a rear section and a contact panel of insulating material interposed between said sections, means for securing said sections and panel in assembled relations, main switch means comprising a first set of spaced contacts on the front face of said panel, terminals for said contacts on the rear face of said panel, a first rotor journalled in said front section and contact bridges carried by the rotor for selectively bridging contacts of said first set, locking means journalled in said front section for controlling the movements of said first rotor, auxiliary switch means comprising a second set of spaced contacts on the front face of said panel, a support of insulating material mounted on the rear of said panel and having a third set of spaced contacts on the rear face thereof, a second rotor journalled in said panel and said support and contact bridges carried by said rotor for selectively bridging contacts of said second and third sets, means journalled in said front section for actuating said second rotor, and means electrically connecting said main and auxiliary switch means to control the flow of current to said auxiliary switch means by said main switch means.

7. In a switch mechanism, a movable block of insulating material having a recess therein, two T-shaped contact bridges of electrically conductive material each comprising a solid leg portion extending into said recess, a

plate-like crosspiece at the outer end of the leg portion and a raised contact surface at each end of said crosspiece on the face thereof opposite said leg portion, said bridges having plane surfaces in engagement with each other, and resilient means in said recess engaging the leg portions of said bridges for urging the bridges outwardly.

8. In electrical switch mechanism, a member comprising insulating material having a recess therein, a conductive bridge for engaging and electrically connecting spaced contacts, said bridge comprising a body portion, spaced contacts projecting from one face of said body portion and a supporting leg extending from the other face of said body portion, said leg having a sliding fit in said recess, a coil spring in said recess engaging the inner end of said leg for urging said bridge toward said contacts, and a second bridge comprising elements the same as said first-named bridge and mounted in said recess, the engaging sides of said bridges being plane surfaces.

9. Electrical switch mechanism comprising insulating means including spaced parallel walls, first and second sets of spaced contacts mounted on the remote faces of said walls, terminals for said contacts on the adjacent faces of said walls, a rotor journalled in and extending through said walls, electrically conductive bridges mounted on and rotating with said rotor for bridging pairs of contacts in said first and second sets, and resilient means interposed between one of said bridges and said rotor for yieldably urging both of said bridges into operative contact with said remote faces of the walls and said contacts.

10. Electrical switch mechanism as defined in claim 9 wherein the bridge contacted by said resilient means is axially movable relative to the rotor and is urged in one direction by said resilient means while the rotor and said other bridge are urged in the opposite direction by said resilient means.

11. Electrical switch mechanism as defined in claim 9 wherein said bridges comprise hub portions keyed to said rotor and radially extending contact carrying arms adapted to engage the contacts of said sets.

12. In electrical switch mechanism, insulating means comprising spaced readily separable wall portions, spaced contacts in the remote faces of said wall portions, a rotor extending through and journalled in said wall portions, a first contact bridge mounted on said rotor for rotary movement therewith and engagement with one of said remote faces, a second contact bridge mounted on the rotor for

rotary movement therewith and axial movement relative thereto and for engagement with the other of said remote faces, and resilient means for holding said walls, rotor and bridges in assembled operative relation.

13. In electrical switch mechanism, supporting means, contacts in remote faces of said supporting means, a rotor journalled in said supporting means and axially slidable relative thereto, a first contact bridge rotatable with said rotor for engagement with one of said remote faces, a second contact bridge rotatable with and axially slidable along said rotor for engagement with the other of said remote faces, and unitary resilient means on said rotor for urging said bridges in opposite directions for yieldable engagement with said faces.

14. In electrical switch mechanism, a contact panel having spaced electrical contacts at one face thereof, a contact support having a wall and legs engaging said panel at the other face thereof for spacing said wall and panel, contacts mounted in the face of said wall remote from said one face of the contact panel, a rotor journalled in said wall and panel, two contact bridges slidably mounted on said rotor for rotation therewith and for sliding engagement with the remote faces of said walls, and resilient means on the rotor for yieldably axially positioning said rotor and bridges.

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