May 9, 1967 A. L. GOOD 3,319,021

ELECTRIC SWITCH

Filed April 4, 1966

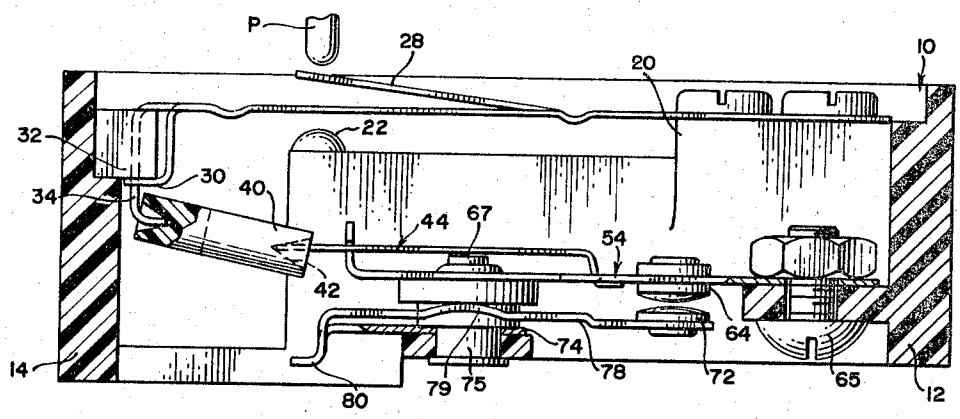

FIG. 1

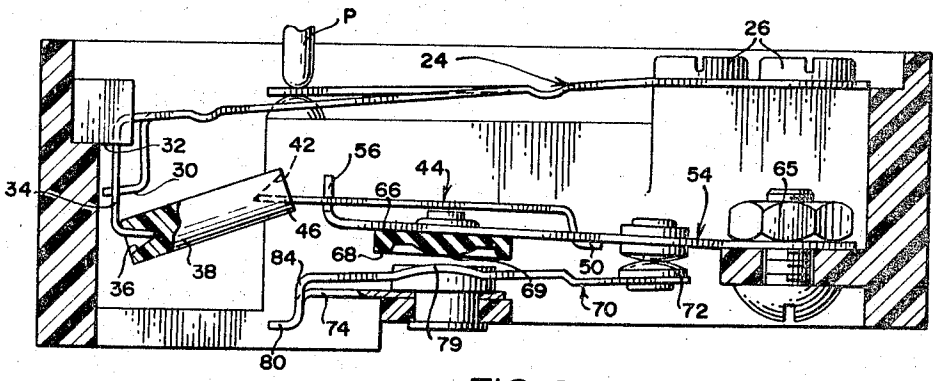

FIG. 2

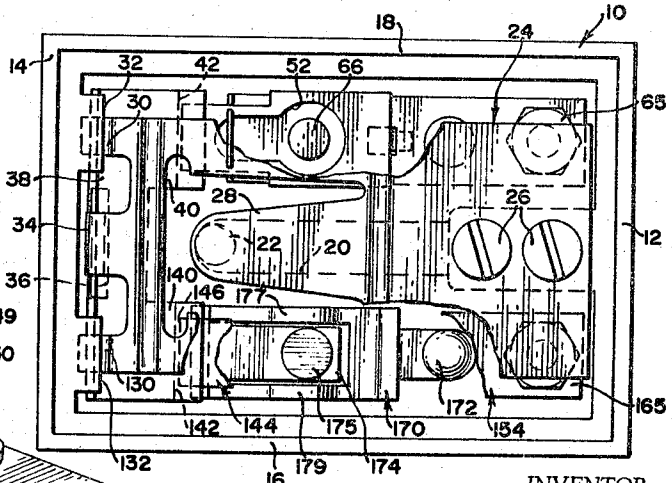

FIG. 4

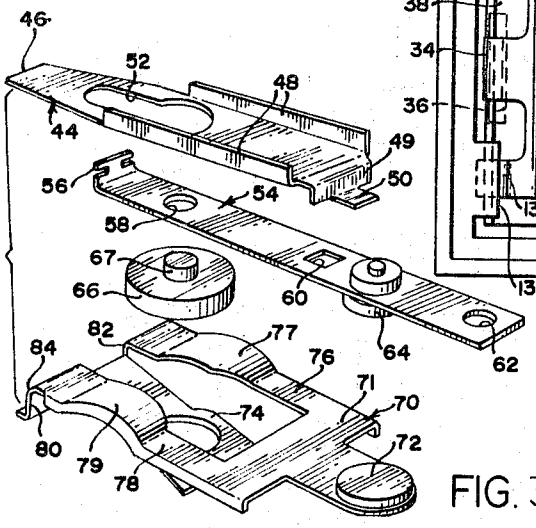

FIG. 3

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ELECTRIC SWITCH

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This invention relates to electric switching devices, and more particularly, to a double pole, single throw switch.

An object of the present invention is to construct a reliable, rugged switch for carrying electrical loads with a minimum of trouble during a long service life.

Another object of the present invention is to provide a compact switch assembly wherein a plurality of switch blades are responsive to a common operating lever.

The present invention has another object in that the force applied to one switch blade of an electric switch is transmitted to the second switch blade thereof with reducing contact pressure.

It is another object of this invention to construct one switch blade of an electric switch from a single strip of material into mounting and operating portions so that force applied to a second switch blade is transmitted to such operating portion.

This invention has another object in that the mounting and operating portions of a switch blade are integrally formed and connected by a flexible hinge.

A further object of the present invention is to provide one switch blade of an electric switch with bowed surfaces that are engaged by force transmitting means movable as a unit with a second switch blade.

The present invention has still another object in the construction of a simple switch assembly including a first arm secured at one end to the housing and a contact disposed on the arm, and a second arm disposed within the housing in proximity to the first arm and a contact disposed on the second arm and cooperating means on the first and second arms to transmit forces therebetween during a switching operation.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a vertical cross-sectional view of a switch embodying the present invention with its contacts in open position;

FIG. 2 is a view similar to FIG. 1, but showing the contacts in closed position;

FIG. 3 is an exploded perspective view of a detail of FIG. 1; and

FIG. 4 is a top plan view of FIG. 1 on a reduced scale with parts broken away.

As is illustrated in FIGS. 1 and 4, the present invention is embodied in a switch housing, indicated generally at **10**, made of any suitable dielectric material and having a substantially rectangular configuration formed by a pair of end walls **12** and **14** joined to a pair of side walls **16** and **18**. A barrier **20** extending from end wall **12** terminates in spaced relation to the opposite end wall **14** and is centrally disposed between the side walls **16** and **18** to divide the housing **10** into spaced contact compartments joined by an end compartment. One end of the barrier **20** defines a mounting ledge and the opposite end is stepped downwardly with a hemispherical stop member **22** on its end portion.

A switch operating lever, indicated generally at **24**, is formed from an elongated strip of spring material having an end secured to the mounting ledge on barrier **20** as by screws **26**. Intermediate its ends, the lever strip **24** has a generally U-shaped cutout defining an operating tongue **28**, the free end of which is disposed above the stop **22** and is normally biased upwardly as viewed in

FIG. 1. The left end of lever strip **24** carries a pair of L-shaped lugs **30** and **130**, one on each edge with their free ends extending under stop elements **32** and **132**, respectively, formed on the inside of housing wall **14**. An L-shaped arm **34** also depends from the end of lever strip **24** with its free end extending in a direction opposite to the lugs **30** and **130**; the arm **34** is centrally disposed between the lugs **30** and **130** and its free end defines a knife edge engaging a V-shaped notch **36** centrally located on a side of a generally rectangular toggle link **38**. The toggle link **38** is made of any suitable dielectric rigid material and, as is shown in FIG. 4, has end projections **40** and **140** extending from the side opposite the notch **36**; the projections **40** and **140** have V-shaped notches **42** and **142**, respectively.

The toggle link **38** with its end projections **40** and **140** define a U-shaped configuration so that it is disposed in the housing end compartment and the projections **40** and **140** extend into the two contact compartments, respectively, for operative connection to the contact carrying assemblies. Since the two contact carrying assemblies are identical in structure, only one assembly is being described in detail, while the other assembly is merely being identified on the drawing by reference numerals having 100 added to the numerals identifying identical structure of such one assembly. For example, a lost motion leaf **44** has a knife edge **46** engaging the notch **42** and it is to be understood that the other lost motion leaf **144** has a knife edge **146** engaging the notch **142**.

As is illustrated in FIG. 3, the lost motion leaf **44** comprises a generally rectangular strip of flexible sheet material having flanges **48** along a portion of each side edge to add rigidity to the strip. On the end opposite to knife edge **46**, the leaf is bent downwardly to form an offsetting wall **49** and terminates in tab **50** which is offset from the plane of the leaf **44**. Intermediate its ends, the leaf **44** has a keyhole slot **52** defining a loose fitting connecting means for a contact carrying blade **54**. The blade **54** is an elongated flexible strip of electric conductive material of generally rectangular configuration having an I-shaped perpendicular flange **56** on one end. The blade **54** has a circular aperture **58** adjacent the end flange **56**, a square aperture **60** intermediate its ends and a circular aperture **62** adjacent its opposite end. A contact **64** is secured to the blade **54** between the square aperture **60** and the circular aperture **62**. The circular aperture **62** defines a mounting aperture for the end of the blade **54** which is thus secured to an internal ledge of the housing **10** by any suitable means, such as a nut and bolt fastener **65**.

The leaf **44** is assembled on the blade **54** by placing the flange **56** in the keyhole slot **52** and sliding the leaf **44** in a direction toward the mounting aperture **62** with the slots of flange **56** receiving the edges of the narrow part of the keyhole slot **52**; during such sliding movement, the tab **50** will fall into the square aperture **60** and the abutment of the edge of aperture by the offsetting wall **49** of tab **50** limits the sliding movement. The bottom edge of the offsetting wall **49** rests on the top surface of the blade **54** so that the leaf **44** is superimposed above the blade **54** in a plane defined by the slots of the flange **56**. A force transmitting member in the form of an annular disc **66**, made of any suitable insulating material such as rubber, has a centrally located mounting stud **67** on its top surface, which is received in the aperture **58** of the blade **54**. As is illustrated in FIG. 2, the undersurface of disc **66** has an annular cutout which has a larger depth adjacent the periphery of the disc **66** and a decreasing smaller depth toward the center; the annular cutout thus provides the undersurface of disc **66** with a peripheral annular bearing surface **68** and a central hemispherical bearing surface **69**. The stud **67** is

integrally secured to the blade 54 as by pressing fitting or snap fitting so that the disc 66 moves as a unit with the blade 54. In its assembled relationship, the upper end of stud 67 is disposed under the enlarged portion of the keyhole slot 52 and thus does not interfere with movement of the leaf 44.

A second contact carrying blade 70, which is stamped from a single flexible strip of electric conductive material, includes a generally U-shaped top plate 71 having a tongue on one end, to which a contact 72 is secured for cooperation with the contact 64. The blade top 71 has a central cut-out of rectangular configuration defining a center leg 74 disposed between a pair of side legs 76 and 78. As is shown in FIG. 3, the side legs 76 and 78 are joined at one end to define the U-shaped configuration of the top plate 71; intermediate their ends, the legs 76 and 78 are bowed upwardly to form arcuate ridges 77 and 79, respectively. The force transmitting disc 66 is superimposed over the arcuate ridges 77 and 79 and is adapted to bear against the same for switching actuation as will be described hereinafter. The end of blade 70, opposite to the contact end 72, has a depending L-shaped flange 80 being integrally formed with the center leg 74 and the side legs 76 and 78. The bottom plate or center leg 74 is a mounting plate and extends perpendicularly from the flange 80 from an edge below the plane defining the side legs 76 and 78; thus, the center leg 74 is disposed in a plane below the plane of legs 76 and 78. The end of center leg 74 has a mounting aperture which receives a fastening device such as a rivet 75 for securing the blade 70 to an internal ledge of the housing 10. With the above arrangement, the junctures between side legs 76 and 78 and the flange 80 define resilient hinges 82 and 84, respectively, whereby the top plate 71 is movable relative to the bottom plate 74.

In the following description of operation of the above device, it will be assumed that the switch is connected between a power source and a device being controlled; accordingly, rivets 75 and 175 are terminals connected to power lines L_1 and L_2 (not shown), respectively, and fasteners 65 and 165 are terminals connected to leads T_1 and T_2 (not shown), respectively, of the controlled device. FIG. 1 represents the normally open condition of the switch 10 wherein contacts 64 and 164 are separated from contacts 72 and 172, respectively, so that both sides of the power lines L_1 and L_2 are broken.

In response to a force applied to plunger P, the lever tongue 28 is depressed and as it moves through the cut-out portion of the lever 24, the lever lugs 30 and 130 are moved away from the housing stops 32 and 132, respectively. The simultaneous movement of lever arm 34 causes the toggle link 38 to pivot about the knife edge 46 until the instant of snap over, which occurs when the V-shaped notch 36 is moved through dead center and past the V-shaped notch 42. The toggle link 38 with its V-shaped notches 36 and 42 receiving the knife edges 34 and 46, respectively, constitutes a snap acting device that causes movement of the leaf 44 (144) with a snap action. As viewed in FIG. 1, the snap acting device exerts a downward force on the leaf 44 (144) until snap over occurs whereupon the leaf is actuated with an upward force. During such snap over the narrow edges of keyhole slot 52 (152) transfer from the bottom to the top edges of the slot in the flange 56 (156).

The upward force on leaf 44 (144) causes an upward movement of the blade 54 (154) whereby the annular surface 68 (168) of the force transmitting disc 66 (166) is displaced from the ridges 77 and 79 (177 and 179) which thus assume their normally bowed condition. Release of the stress on the bowed ridges 77 and 79 (177 and 179) permits the entire top plate 71 (171) to flex upwardly about the flexible hinges 82 and 84 (182 and 184), whereupon the inherent resiliency of the blade plate 71 (171) biases its contact 72 (172) into engagement with the contact 64 (164). The switch will remain

in the closed contact position of FIG. 2 as long as the plunger P is depressed.

Upon release of the actuating force on the plunger P, the operation of the switch mechanism is reversed, i.e., the lever 24 will move upward causing the snap acting device to reverse its force on leaf 44 (144) to a downward force as viewed in FIG. 1. The upward movement of lever 24 is limited by engagement of the lever lugs 30 and 130 with the housing stops 32 and 132, respectively. The downward force on the leaf 44 (144) and on the blade 54 (154) is transmitted by the disc 66 (166) to the bowed ridges 77 and 79 (177 and 179); accordingly, the ridges are stressed causing the blade plate 71 (171) to flex downwardly about the flexible hinges 82 and 84 (182 and 184) whereupon the contact 72 (172) is separated from the contact 64 (164) and the switch is returned to its normal open position. The amount of stress applied to the bowed ridges 77 and 79 (177 and 179) is limited by the engagement of the disc's hemispherical surface 69 (169) with the top of the fastening rivet 75 (175) which defines stop means for the disc 66 (166).

Inasmuch as the present invention is subject to many variations, modifications and changes in details, it is intended that all matter contained in the above description or shown on the accompanying drawing, shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an electric switch, the combination comprising
a switch housing,
first contact carrying switch blade means having an operating portion and a mounting portion secured to said housing,
second contact carrying switch blade means movably mounted in said housing and cooperating with said first blade means to define switch open and closed positions,
flexible hinge means between said operating portion and said mounting portion biasing said operating portion toward said second blade means whereby said operating portion is normally biased to a switch closed position,
force transmitting means on said second blade means engaging the operating portion of said first blade means for moving the same to a switch open position, and
force applying means including a leaf member having spaced parts operatively connected to said second blade means one of said parts defining a lost motion connection with said second blade means causing said force transmitting means to move relative to the operating portion of said first blade means, and
actuating means acting on said leaf member to reverse the action of said second blade means whereby said first and second blade means are movable during a switching operation.

2. The invention as recited in claim 1 wherein said operating portion includes ridge means bowed toward said force transmitting means.

3. The invention as recited in claim 2 wherein said force transmitting means comprises disc means having an annular undersurface engaging said ridge means.

4. The invention as recited in claim 3 wherein the operating portion of said first blade means includes a pair of side legs and the mounting portion of said first blade means includes a central mounting leg, and wherein said disc means has a central hemispherical surface disposed for movement between said pair of side legs and relative to said central mounting leg.

5. In an electric switch, the combination comprising
a switch housing,
first contact carrying switch blade means including a pair of side legs, a central mounting leg having a portion secured to said housing, and flexible hinge means defining between said side legs and said

mounting leg, said pair of side legs having bowed ridge means defining operating portions,

second contact carrying switch blade means in said housing cooperable with said first blade means to define switch open and closed positions,

force transmitting disc means on said second blade means having an annular undersurface engaging said ridge means and having a central hemispherical surface disposed for movement between said pair of side legs,

force applying means acting on said second blade means whereby said force transmitting disc means acts against said ridge means and normally biases first blade means to a switch open position,

actuating means operative to reverse the action of said second blade means whereby said first and second blade means are movable during a switching operation, and

stop means rigidly mounting said central mounting leg to said housing and being engaged by said hemispherical surface to limit bowing of said ridge means.

6. The invention as recited in claim 5 wherein said housing includes a pair of switching compartments connected by an end compartment, said first and second

blade means comprises a pair of identical first and second blades with one pair mounted in each switching compartment, and wherein said actuating means includes an operating lever and snap acting means operatively connected between said lever and the force applying means for each of said second blades.

7. The invention as recited in claim 6 wherein said lever has a fixed portion mounted on said housing and an integrally formed operating tongue bent upwardly from said fixed portion.

8. The invention as recited in claim 7 wherein said housing has a stop element engageable by said operating tongue to limit the actuating force on said lever, and wherein said lever and said housing have cooperating stop means to limit return movement of said lever when the actuating force is released.

References Cited by the Examiner

UNITED STATES PATENTS

2,751,450 6/1956 Smith ..... 200—67

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