United States Patent

[11] **3,617,673**

[72] Inventor **Donald E. Weston**
East Sebago, Maine

[21] Appl. No. **47,429**
[22] Filed **June 18, 1970**
[45] Patented **Nov. 2, 1971**
[73] Assignee **H. K. Porter Company, Inc.**
Chicago, Ill.

[54] **CONTACT STRUCTURE**
12 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** ..... **200/166 E**
[51] **Int. Cl.** **H01h 1/46**
[50] **Field of Search** ..... 200/166 E, 166 D, 168 G, 166 BC, 166 BH, 166 BF, 166 E, 166 D

[56] **References Cited**

UNITED STATES PATENTS

3,526,736	9/1970	Ramrath	200/166 D
3,009,043	11/1961	Goodwin, Jr. et al.	200/166 E
2,891,134	6/1959	Ramrath	200/166 X
3,504,147	3/1970	Christman et al.	200/168 G
2,600,211	6/1952	Cushing	200/166 D X
2,751,471	6/1956	Wills	200/166 E

Primary Examiner—H. O. Jones
Attorney—Gary, Parker, Juettner, Pigott & Cullinan

ABSTRACT: Contact structure having a pair of juxtaposed contact assemblies each having a generally L-shaped housing and terminal means at the free end of one leg of the housing. Contact members pivotally mounted on the other leg and generally paralleling the one leg to provide a reverse loop path of current flow. Means biasing the contact members away from the one leg including a yieldable moisture-impervious material filling the space between the contact members and the housing to prevent entry of moisture therebetween.

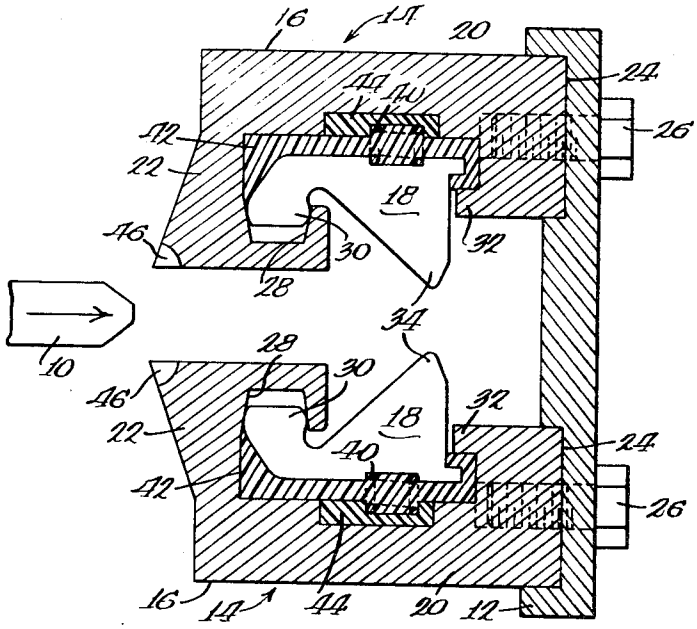


Fig. 1.

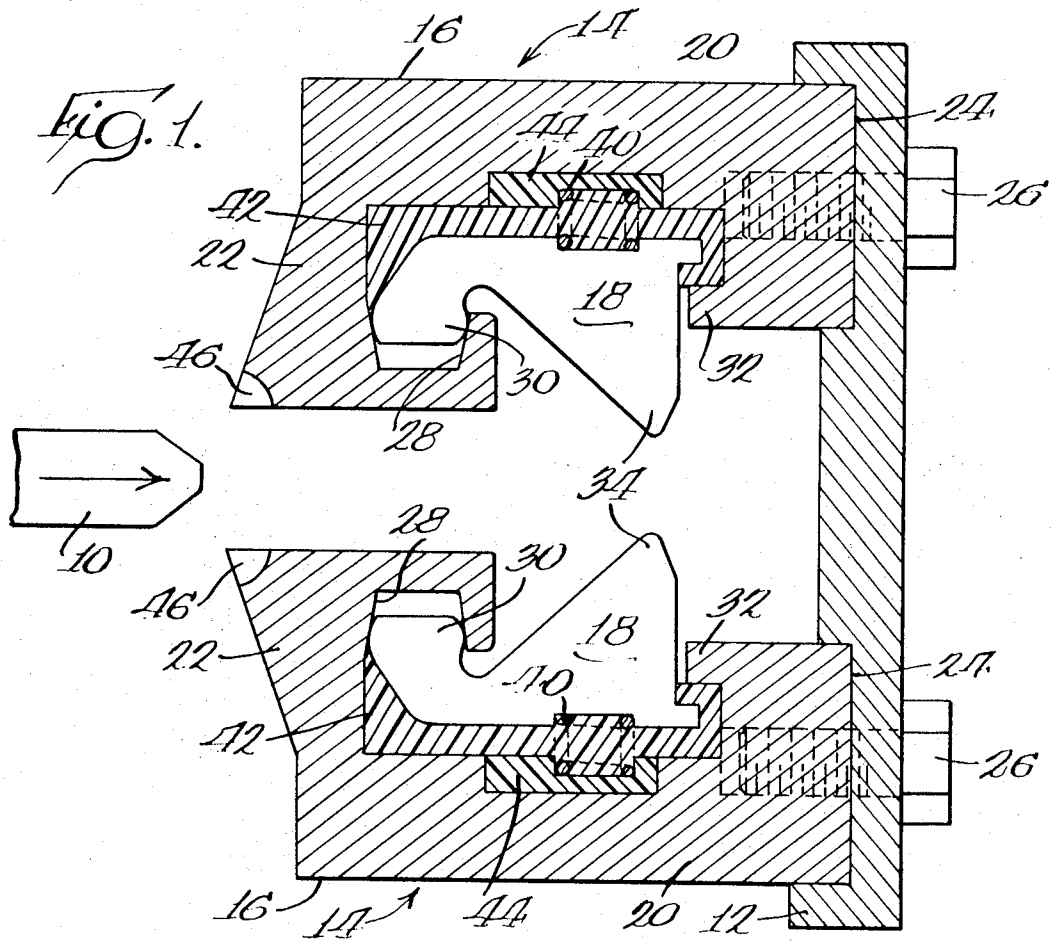
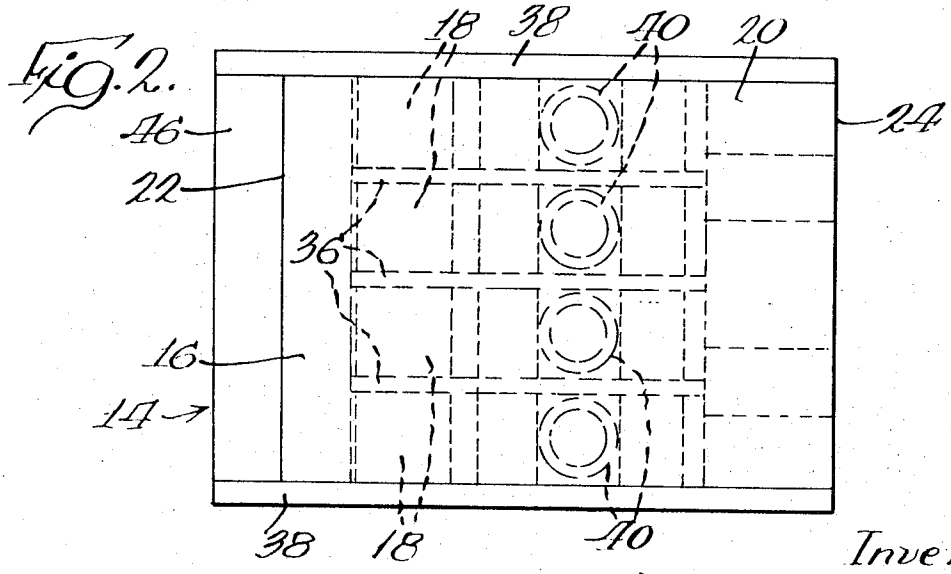


Fig. 2.



Inventor:
Donald E. Weston
By Gary, Parker,
Juettner, Pigott & Cullinan
Attys

CONTACT STRUCTURE

BACKGROUND OF THE INVENTION

High-tension electric switch gear is required to satisfy many specifications, two of which are a particular concern of this invention: first, the requirement that the electrical contact be maintained between the switch blade and its stationary contact under severe electrical stress, such as that occasioned upon short-circuiting, which may produce electrical and/or electromagnetic forces that tend to drive the switch blade out of its contact (blowback or blowout forces); and second, the requirement for full operational service when installed outdoors, even when exposed to severe icing conditions where ice may build up several inches thick over both the switch blade and its stationary contact.

SUMMARY OF THE INVENTION

The object of the invention is to provide an improved contact structure for high-tension electric switch gear, especially switches of the so-called knife blade and side break types, which provides, first, a reverse loop path of current flow from the switch terminal to the switch blade such that the electrical or electromagnetic stress or "blowout" force is so directed as to hold the switch blade in rather than to drive it out of the contact, and second, means mitigating icing of critical parts of the contact structure and essentially limiting icing to external accumulation, together with an external configuration minimizing adverse effects from such external accumulation of ice.

Another object is to provide a very compact, efficient, practical and economical contact structure fully satisfying the requirements of the art.

Other objects and advantages will become apparent as the description proceeds.

THE DRAWINGS

FIG. 1 is a vertical section of a preferred embodiment of the contact structure of the invention, showing the relationship thereof to a switch blade; and

FIG. 2 is a plan view of said contact structure.

DETAILED DESCRIPTION

WIth reference to FIG. 1, there is illustrated fragmentarily and somewhat schematically a switch blade 10 which may be assumed to be movable horizontally toward and away from a stationary terminal structure 12, the blade being movable from left to right to adjacent the terminal to a switch-closed position and from right to left away from the terminal to switch-open position. Usually, especially in a side break switch, the blade will be swung in an arcuate path, the terminus of which path is adjacent the terminal structure 12.

Mounted on the terminal structure 12 for engagement with the blade 10 at the terminus of its path of movement are contact means, here comprised of a pair of identical contact assemblies 14 juxtaposed to one another at opposite sides of the terminal portion of the path of blade movement. Each of the assemblies 14 is comprised of a conductive housing 16 formed preferably of silver-coated copper, or of brass, aluminum or any other suitable corrosion-resistant highly conductive material, one or more contact members 18 pivotally mounted in the housing, and means to be described hereinafter for biasing the contact surfaces of said member or members into the path of blade movement and against the blade in the switch-closed position thereof.

The housing 16 of each assembly 14 is generally of L-shape, having a first leg 20 which parallels the path of blade movement and a second leg 22 which extends from the outward end of said first leg toward the blade path transversely of said path. The inner or free end of the leg 20 is provided with terminal means, which in the illustrated embodiment is comprised of an end face 24 abutting the terminal structure 12 and tapped holes opening to said face for reception of bolts 26 which

secure the housing to the structure 12 in electrically conductive relationship therewith. The transverse leg 22 of the housing is provided on the rearwardly facing surface thereof with means for pivotally mounting the contact member or members 18, and the latter extend rearwardly from said surface of the leg 22 in spaced generally parallel relation to the leg 20. In this manner, current is conducted from the terminal structure 12 to the blade 10 via the leg 20, the leg 22 and the contact member 18, i.e., in a reverse loop path rather than a direct path. As a consequence, forces occasioned under conditions of extreme electrical stress, e.g., short circuit will be caused to be directed normal to the blade, whereby to neutralize the forces relative to any blowout characteristic, and simultaneously with the result that the contact members 18 are driven away from the respective housings legs 20 and into even more firm engagement than usual with the blade, thereby to insure good electrical conductivity with the blade 10 securely held within the contacts under severe electrical stress.

To mount the contact member or members on the respective housing 16, the leg 22 of each housing is provided with a channel 28 extending from side to side thereof and open at its ends. Each contact member 18 includes a base portion 30 of partly cylindrical configuration inserted in the channel 28 and thereby pivotally mounting the member on the leg 22. To prevent disassociation of the contact members from the housing, a hooklike projection 32 extends from the leg 20 around a complemental projection on the opposite end of each contact member. The resultant combination of legs 20 and 22, channel 28 and projections 32 provides a slotlike opening in each housing 16 within which the contact members are pivotally mounted. Preferably, the housing closely circumscribes the contact members and the contact members are slidably inserted in the housing from the sides thereof. For contact with the blade 10, each contact member 18 has a nose portion 34 projecting from the slot in the housing into the path of blade movement.

As shown in FIG. 2, each assembly 14 is preferably includes a plurality of the contact members 18 each separated from adjacent ones thereof by an interposed platelike insulator 36 of substantially the same shape as the contact members and each mounted on the housing 16. The assembly of contact members and insulators is retained within the respective housing by insulated side plates 38 closing the opposite ends of the slotlike opening in the housing. The insulators 36 and the insulated side or end plates 38 serve to aid in maintaining the integrity of the reverse loop current path. The number of contact members 18, and thus the overall width of the housing 16 of each assembly 14 is a function of the continuous and momentary current ratings of the switch. For a switch of very low rating, there may be only one contact member required, whereas for a switch of high rating, there would be a plurality of the contact members as herein indicated. In any of these events, the structure is such as to readily lend itself to construction in increased width with increased numbers of contact members in order to adapt the contact structure to substantially any switch as may be desired.

For purposes of normally disposing the contact members 18 in the path of movement of the switch blade 10, and for causing said members to resiliently but forcibly engage the blade in switch-closed position, biasing means are provided between the housing and the contact members in the form preferably of an individual spring 40 for each of the contact members and a resilient, or at least yieldable, material 42 filling the space between the housing and the contacts. The springs 40 may be of any form or type desired, such for example as compression springs as illustrated herein. To maintain the reverse loop current path previously described, the springs are insulated from at least one of the housing and the respective contact member, such for example as by means of a pad 44 of insulating material inserted between the spring and the housing. The primary purpose of the springs 40 is, of course, to establish and maintain the proper contact pressure between the respective contact member and the blade 10 in the switch-closed position.

THe resilient material 42 may aid in providing the contact biasing force, or in small switches may provide little if any of the biasing force, or alternatively may provide little if any of the biasing force, all as desired or required for the particular application of the invention. The primary requirement of the material, outside of yieldability to accommodate contact movement, is that it be moisture impervious, as the principal purpose of the material 42 completely filling the space between the housing and the contact members is to prevent entry of moisture to said space and thereby to prevent formation of ice behind the contacts that would mitigate against proper operation of the switch under outdoor icing conditions. To attain this objective, the material is preferably a yieldable, moisture-impervious silicone foam which is foamed in place behind the contact members 18 between the end plates 38 to completely isolate the contact members and the interposed insulation 36 from the housing except at the lines of electrically conductive engagement between the base portions 30 of the contacts 18 and the leg 22 of the housing.

Thus, when it rains, and especially under icing conditions, moisture cannot enter behind the contacts 18 and cannot gain access to the contact pivots 30 or the springs 40 whereby the assembly of contacts and springs is retained fully operational under all conditions. As an additional anti-icing feature, the outer or forward face of the housing at the free end portion of the leg 22 is formed at an oblique angle to the bath of the blade movement, as indicated at 46, which serves to aid the switch blade in breaking through ice accumulated on the switch whether the switch be in its open or closed position when icing occurs. Specifically, if the switch was closed when icing occurred, and the blade is then moved in opening direction, the sloping surfaces provided by the angular portions 46 on the housings define breaking points where the ice can crack or shear and then slide off the housing to facilitate opening of the blade. If the switch was open when icing occurred, and the blade is then moved in closing direction, the angular portions 46 act as knife edges defining a sharp fulcrum about which the ice can crack or shear to facilitate opening of the space between the assemblies 14 and movement of the blade to switch-closed position. Additionally, when the contact assemblies are mounted horizontally and thus in vertical alignment with one another, as shown herein, the upper assembly shields its own contacts, the lower assembly and the space therebetween so as further to minimize the icing problem.

Thus, the objects and advantages of this invention have been shown to be attained in a convenient, economical and practical manner.

While I have described what I regard to be the preferred embodiment of my invention, it is to be appreciated that various changes, rearrangements and modifications may be made therein without departing from the scope of the invention, as defined by the appended claims.

I claim:

1. A contact structure for electric switches having a movable switch blade comprising a housing, a contact member movably mounted in said housing, and means normally biasing said contact member away from said housing, said biasing means comprising a yieldable moisture-impervious material filling the space between said housing and said contact member.

2. The structure of claim 1 wherein said biasing means also includes a spring between said housing and said contact member.

3. The structure of claim 1 including a plurality of said contact members mounted in parallel to one another in said housing, insulated spacers between said contact members, and a common filling of said material between the housing and the assembly of said contact members and spacers.

4. The structure of claim 1 wherein said housing has a slotlike opening therein, a plurality of said contact members mounted parallel to one another in said opening, insulated spacers between said contact members, a common filling of said material within said slot between the housing and the assembly of said contact members and spacers, and insulated end plates closing the opposite ends of said opening and enclosing said material.

5. The structure of claim 4 wherein said biasing means includes a spring disposed between each of said contact members and said housing and individually biasing said contact members away from said housing.

6. A contact structure for electric switches having a movable switch blade comprising a generally L-shaped housing having terminal means at the free end of one leg thereof, a contact member pivotally mounted on the other leg of said housing and generally paralleling said one leg thereof to provide a reverse loop path of current flow, and means insulated from one of said housing and said contact member for biasing said contact member away from said housing.

7. The structure of claim 6, said housing including a channel portion in said other leg thereof, said contact member having a partly cylindrical protuberance thereon engaging in said channel and pivotally mounting said contact member on said other leg, and a hooklike projection on said one leg of said housing extending around the opposite end of said contact member for preventing inadvertent disassociation of said contact member from said housing.

8. The structure of claim 7, said housing comprising a one-piece member having a slotlike opening therein circumscribing said contact member on three sides and part of the fourth side thereof, said contact member being slidably insertable in said slotlike opening from the side of said housing.

9. The structure of claim 6, said biasing means including a nonconductive, moisture-impervious, yieldable material filling the space between said contact member and said housing.

10. Contact means for electric switches having a switch blade movable in a predetermined path comprising a pair of contact assemblies disposed to opposite sides of the path of blade movement adjacent the terminus of said path; each assembly comprising a generally L-shaped housing having one leg thereof generally parallel to the path of blade movement and the other leg thereof extending transversely of said path, the free end of said one leg being disposed at the terminus of the path of blade movement and having terminal means thereon, the free end of said other leg being disposed adjacent the path of blade movement and spaced from the terminus of said path, a contact member pivotally mounted on said other leg generally parallel to said one leg and extending toward the free end of said one leg, and means between said one leg and said contact member insulated from at least one of them for biasing said contact member in to the path of blade movement, the contact members of said two assemblies resiliently engaging the switch blade at the terminus of its path of movement and said assemblies defining reverse loop current paths from said terminal means to the blade.

11. The contact means of claim 10 including a plurality of contact members in the housing of each of said assemblies, said biasing means including a spring between the housing and each of said contact members insulated from at least one of them, and a nonconductive, moisture-impervious, yieldable material filling the space between said housing and said contact members.

12. The contact means of claim 10 wherein the free end of said other leg of each of said assemblies has an end portion of oblique angular formation facing away from the terminus of said path for shearing ice from the assemblies and the switch blade when the switch blade is moved following icing conditions.

* * * * *