

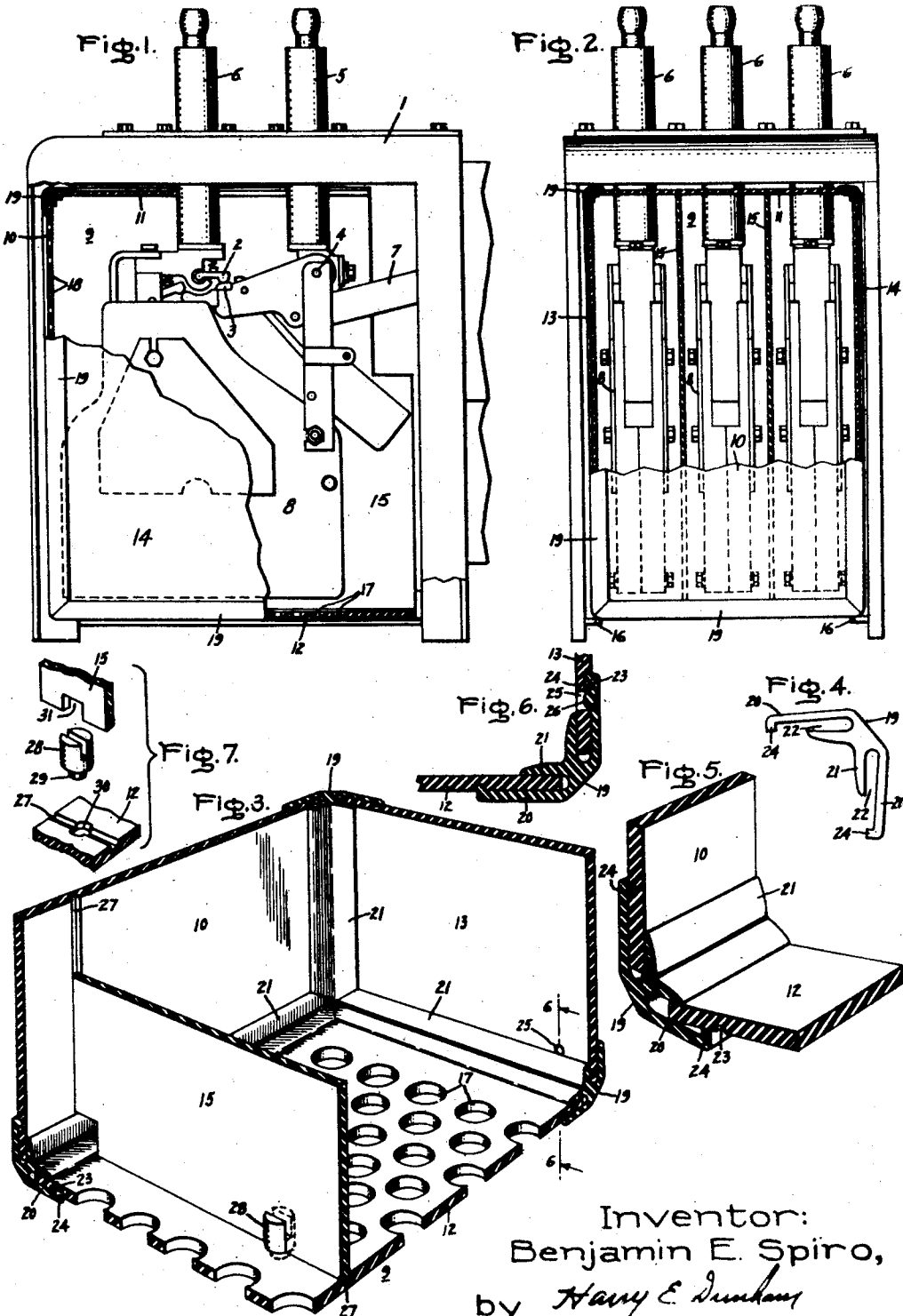
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INSULATING HOUSING FOR ELECTRICAL APPARATUS

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INSULATING HOUSING FOR ELECTRICAL APPARATUS

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My invention relates to insulating housings for electrical apparatus such as electric circuit breakers and more particularly for electric air circuit breakers of the type disclosed and claimed in Linde Patent 2,293,513, granted August 18, 1942, and assigned to the same assignee as the present application. Specifically my invention is an improvement on Boehne Patent 2,293,452, granted August 18, 1942, and also assigned to the same assignee as the present application.

As is disclosed and claimed in the above mentioned Boehne patent, air circuit breakers of the type disclosed in the above mentioned Linde patent produce large amounts of highly heated arc gases in the short interval of time during the circuit interrupting operation. The explosive-like generation of incandescent gases by the circuit breaker during the interrupting operation may cause serious injury and damage to adjacent operators and equipment unless the gases are sufficiently cooled to an insulating state before being vented from the arc chute or breaker housing. The cooling of these gases introduces another problem, i. e., possible reduction of arc interrupting capacity due to excessive back pressure particularly where a compact design is required. In accordance with the above mentioned Boehne patent the arc chutes of the circuit breaker are enclosed by a box-barrier arrangement of insulating material which deflects and renders harmless the arc and switching gases blown from the arc chutes of the circuit breaker while maintaining a high interrupting capacity of the circuit breaker and a high insulation level of the complete equipment. The box-barrier construction used heretofore comprised a plurality of sheet-like members or panels of insulating material which were arranged in the form of a box and which might be divided by a plurality of barriers to isolate the various arc chutes of the circuit breaker. These box-barriers were usually fastened together by a plurality of screws or other metal fastening means.

It would be desirable to provide a box-barrier which does not employ any metal fastenings of any kind which has a greatly increased electrical creepage path which is more effective from the standpoint of gasproofness, which has a more pleasing finished appearance, and furthermore which is less expensive to manufacture.

It is an object of my invention to provide an insulating housing or box-barrier for gas producing electrical apparatus such as electric air circuit breakers which has the advantages enumerated above.

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It is another object of my invention to provide a new and improved insulating housing for the arc chutes of electric circuit breakers.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 is an elevational view, partly in section, of an electric circuit breaker embodying my invention; Fig. 2 is an end view, partly in section, of Fig. 1; Fig. 3 is an enlarged perspective view of a portion of the insulating housing of Figs. 1 and 2; Fig. 4 is an end view of a portion of Fig. 3 prior to assembly as in Fig. 3; Fig. 5 is a perspective view of a portion of Fig. 3 illustrating one step in the assembly; Fig. 6 is a sectional view taken on line 6—6 of Fig. 3, and Fig. 7 is an enlarged, exploded view of a portion of Fig. 3.

Referring now to the drawing, there is illustrated an electric circuit breaker substantially identical with the electric circuit breaker disclosed and claimed in copending application Serial No. 568,983, Spiro et al., filed concurrently with the present application and assigned to the same assignee as the present application which has matured into Patent 2,445,190, granted July 13, 1948. The electric circuit breaker illustrated comprises a main supporting frame 1, for the movable contact structure which comprises a relatively fixed contact 2 and a movable contact 3 which is pivotally mounted at 4 on one end of the circuit breaker conductor stud 5. The stationary contact 2 is electrically connected to a conductor stud 6. Pivotaly mounted contact 3 is operated by means of an operating rod 7 connected to an actuating mechanism (not shown) preferably carried by the frame 1. The conductor studs 5 and 6 serve as plug type disconnect contacts for the circuit breaker unit and when they are connected to a live power circuit relative separation of the contacts of the circuit breaker will cause an arc to be drawn.

For the purpose of interrupting this power arc an arc extinguishing structure generally indicated at 8 is mounted in the frame 1 so as to receive the arc. Suitable means, such as magnetic blow-out coils are provided to force the arc into the arc chute. Generally such a circuit breaker comprises a plurality of arc chutes, one for each phase conductor of the power circuit to be controlled. As illustrated in Fig. 2 of the

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drawing, three arc chutes are shown each connected to a different set of conductor studs to control the conventional three-phase electric circuit. As illustrated in the drawings the arc chutes 8 are of the so-called "down-draft type" such as is disclosed in Linde Patent 2,335,068, granted November 23, 1943, and assigned to the same assignee as the present application. By down-draft type is meant that the arc gases from the arc chute are discharged downwardly. It will be understood, however, that my invention is equally applicable to circuit breakers such as are shown in the above mentioned Boehne patent where the arc gases from the arc chute are discharged laterally rather than downwardly.

The circuit breaker thus far described would probably in the case of severe overloads or short circuits eject incandescent gases in varying amounts. This obviously cannot be tolerated in an indoor station where such breakers are usually employed, as attendants might be seriously burned and also damage to other equipment might result in the case of flashover due to the heated gases within the breaker enclosure which is usually a metal enclosure. In order more completely to house the interrupting device and guard against injuries or flashover due to possible ejection of hot gases, there is provided an insulating housing or box-barrier 9. This housing comprises a front wall or panel 10, a top wall or panel 11, a bottom wall or panel 12, side plates or panels 13 and 14, and a plurality of partitions or interphase barriers 15. These panels are really sheet-like members formed of insulating material and joined together as a unitary structure in the form of a box-like housing which is inserted into the position indicated in Figs. 1 and 2 and supported by any suitable means, such for example as the lugs 16 in Fig. 2 extending from the frame 1.

In accordance with the disclosure of the above mentioned Boehne patent, the box-barrier 9 receives the gases discharged from the arc chute 8 and permits these gases to escape to atmosphere through a plurality of openings such as 17 in the bottom wall 12 and a plurality of openings such as 18 in the front wall 10. By the time these gases are exhausted to atmosphere through openings 17 and 18 they are sufficiently cooled and by virtue of the box-barrier 9 flashover is prevented since the arc chutes 8 are isolated from each other and the arc gases are prevented from impinging against the metallic frame of the circuit breaker until they are sufficiently cooled.

Heretofore the box-barriers such as 9 comprised a plurality of insulating plates fastened together by suitable metal screws or rivets. The metal screws or rivets greatly increase the probability of flashover and furthermore the construction was not gas proof at the joints which tended to increase the possibility of flashover.

In accordance with my invention the box-barrier is constructed with substantially no metal parts at all and furthermore the joints are substantially gas proof and provide a very long creepage path. In addition a much more pleasing construction is presented which is much less expensive to manufacture.

In accordance with my invention I provide a junction strip or insulating member for joining two adjacent sheet-like members at a predetermined angle, which is preferably a right angle. This junction strip or molding is generally indicated in the drawings as 19 and comprises a strip of insulating material which is produced by

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extruding through a special die of the desired configuration, a suitable plastic material. I have found that plastic material such as cellulose esters and particularly aceto-butyrates is a very desirable extrudable material from which to form the strips or moldings 19 for in addition to being insulating, these materials are tough, hard and resilient and which properties account for the effectiveness of the corner jointing members for the insulating housing of my invention. The strips 19 are produced in the particular cross-sectional configuration clearly indicated in Fig. 4 comprising a pair of outer angularly disposed flanges 20 arranged somewhat less than right angles with each other, and an inner L-sectioned member 21 intermediate the flanges 20 and integral with said flanges so as to define a pair of longitudinal grooves or recesses 22 for receiving edges of the sheet-like members or panels such as 10, 11, 12, 13 and 14. The strips or moldings 19 when initially extruded as shown in Fig. 4, also have the outer flanges 20 curved somewhat in arcuate form. The material is resilient, as already stated, so that when two adjacent sheet-like members are assembled in the associated recesses 22 the curvature will disappear for the flanges 20 will press sealingly upon the panel surfaces so as to lie substantially flat thereon as is shown in Figs. 3 and 6 when the panels are opened to their full predetermined 90 degree relationship one with the other.

In order to lock the insulating member 19 to the sheet-like members or panels such as 10, 11, 12, 13 and 14, each of the sheet-like members or panels is provided with a shallow, longitudinally extending groove 23 near to the edge of the panel and parallel to said edge. The outwardly extending edges of the flanges 20 of molding 19 preferably terminate in a longitudinally extending tongue 24 which is adapted to fit into a cooperating groove 23 of an associated panel thereby effectively providing means for holding the strip 19 securely to the sheet-like member or panel. Because the molding 19 is hard and tough, it serves adequately as the means for effectively joining together two adjacent panels disposed at a predetermined angle with respect to each other. It will be obvious that with this arrangement any two adjacent panels may be prearranged at said predetermined angle with each other after which a joining strip 19 can then be slid endwise into place between them with the tongues 24 fitting nicely into the grooves 23. I have found, however, that by making the insulating strip 19 from resilient material, a sheet-like member or panel may be sprung directly into the molding, as is clearly shown in Fig. 5 where the sheet-like member 12 is depicted in the process of being entered laterally into the insulating strip 19 which latter is already assembled in place on the panel 10. Conversely, the length of joining strip or molding 19 may be sprung directly onto the edge of a panel in preference to sliding it lengthwise into position on the grooved panels, if desired.

It will be understood from the above description that the four molding or insulating members joining panels 10 and 13, 10 and 14, 10 and 12, and 10 and 11 can not slide longitudinally out of position once the box-barrier is assembled for these four members 19 which form a rectangular frame around the front panel 10, are in abutting engagement with one another at each of their ends where they have been cut so as to form mitered corner joints as clearly illustrated

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toward the bottom of Figure 2. It is possible, however, for the four side moldings or insulating strips 19 which join the panels 11 and 13, 11 and 14, 12 and 13, and 12 and 14 to slide longitudinally out of position when employing the tongue and groove method described above for only one end of each of these four side moldings is in abutting engagement at one of the aforementioned mitered corner joints. To prevent these last four moldings or insulating members from creeping away so as to open up these mitered corner joints of the box-barrier, I provide additional means for keying these particular moldings into position which is best illustrated by Figs. 3 and 6. A small drilled hole 25 is provided in the panel such as 13 between the groove 23 and the edge of the panel. The molding or insulating member 19 is then permanently deformed by means of a hand punching tool in a manner indicated at 26 in Fig. 6, so that the extension which projects into the hole or opening 25 prevents any relative sliding movement between the molding 19 and the panels such as 12 and 13.

The interphase barriers 15 are supported in grooves such as 27 provided in the panels 10, 11, and 12. In order to lock each of these barriers in position in grooves 27 a single slotted dowel pin 28 best shown in Figs. 3 and 7 may be provided. This dowel pin has a portion of reduced cross section 29 adapted to be inserted in a cooperating opening 30 formed in bottom plate 12, as is clearly shown in Fig. 7. The slot in the dowel pin 28 cooperates with a notch 31 cut into the interphase barrier 15. This dowel pin may be made of metal if desired since it does not extend outside the box barrier. Preferably, however, this dowel pin is also formed of insulating material.

In order to assemble the box-barrier 9 the bottom and front panels 12 and 10, respectively, could first be joined together by sliding or springing the molding 19 between them into position. Next the side plate 13 could be put into position while the vertical molding 19 between panels 10 and 13 is slid into position. The two interphase barriers 15 are then positioned with their lower and side edges in grooves 27 and with the locking dowel pins 28 in place as depicted in Figure 3. The top panel 11 can then be placed into position so that its grooves corresponding to 27 in 12 engage the upper edges of interphase barriers 15. The upper horizontal molding 19 between panels 10 and 11 may then be slid into position from the end to which panel 14 is to be connected. The vertical molding 19 between panels 10 and 14 must then be sprung onto front panel 10 after which panel 14 is then sprung into position into this molding. At this stage of the assembly, all panels and barriers of the box-barrier 9 are properly in place, interlockingly keyed therein by the intumed flanges 24 of the four moldings 19 which latter now completely enframe the front panel 10. It will be evident that these four moldings constituting the frame around the panel 10 are themselves interlocked effectively and permanently together for they are incapable of any end movement due to their abutting relationship at the mitered corner joints. The remaining four side moldings which are horizontally disposed and which join the panels 11 and 13, 12 and 13, 12 and 14, and 11 and 14 now can be slid lengthwise into position, whereupon the five panels 10, 11, 12, 13 and 14, the two interphase barriers 15 and eight

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moldings 19 are all interlocked into a rigid, completely insulated box-like gas proof structure. To prevent relative movement between the last four horizontal moldings 19 which were assembled in the box-barrier 9, these moldings may be deformed by a hand-punching tool so that the depression 26 formed thereby engages with cooperating openings 25 in the panels 13 and 14.

From the above discussion it will be obvious that I have provided a box-barrier construction containing no metal members whatever, which includes a very long creepage path at the joints for minimizing voltage breakdown therethrough, which has a very pleasing appearance and which is simpler and less expensive to manufacture than constructions used heretofore. Moreover, the joints are substantially gas proof for the resilient flanges 20 press effectively in weather-strip fashion upon the surface of the panels due to the flange curvature and because I have made the included angle between these flanges less than that between the associated adjacent panels.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An insulating housing for protecting electrical apparatus, said housing including a plurality of insulating side panels maintained juxtaposed in predetermined angular relationship, means for conjoining together certain adjacent edges of said panels comprising a junction strip of resilient insulating material which integrally includes a pair of outer flanges angularly disposed relative to one another and an inner L-sectioned member spaced therefrom to define therebetween a pair of longitudinal recesses in said strip into which said certain adjacent panel edges are received, the included angle between the flanges of said flexible strip when free of said panels being less than that maintained between said adjacent panels so that said flanges press effectively upon the panel surfaces to form a gas seal thereat, and means for locking said certain panel edges in said recesses including cooperatively matching projections and indentations for said panel edges and said junction strip.

2. An insulating housing for protecting electrical apparatus, said housing including a plurality of insulating side panels maintained juxtaposed in predetermined angular relationship, means for conjoining together certain adjacent edges of said panels comprising a junction strip of resilient insulating material which integrally includes a pair of outer flanges angularly disposed relative to one another and an inner L-sectioned member spaced therefrom to define therebetween a pair of longitudinal recesses in said strip into which said certain adjacent panel edges are received, the included angle between the flanges of said flexible strip when free of said panels being less than that maintained between said adjacent panels so that said flanges press effectively upon the panel surfaces to form a gas seal thereat, and means for locking said certain panel edges in said recesses comprising a projecting longitudinal tongue integral with each

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said flange and a corresponding groove cooperating therewith in each said certain panel edge.

3. An insulating housing for protecting electrical apparatus, said housing including a plurality of insulating side panels maintained juxtaposed in predetermined angular relationship, means for conjoining together certain adjacent edges of said panels comprising a junction strip of resilient insulating material which integrally includes a pair of outer flanges angularly disposed relative to one another and an inner L-sectioned member spaced therefrom to define therebetween a pair of longitudinal recesses in said strip into which said certain adjacent panel edges are received, the included angle between the flanges of said flexible strip when free of said panels being less than that maintained between said adjacent panels so that said flanges press effectively upon the panel surfaces to form a gas seal thereat, and means for locking said certain panel edges in said recesses comprising a projecting longitudinal tongue integral with each said flange and a corresponding groove cooperating therewith in each said certain panel edge, the said cooperating tongues and grooves constituting the sole fastening means for preventing separation between said certain panel edges and said junction strip.

4. An insulating housing for protecting electrical apparatus, said housing including a first panel having a plurality of straight peripheral edges and an associated side panel maintained juxtaposed adjacent each said peripheral edge in predetermined angular relationship with said first panel, a plurality of junction strips for conjoining each said peripheral edge respectively to

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the edge of its associated side panel, each strip comprising a length of resilient insulating material which integrally includes a pair of outer flanges angularly disposed relative to one another and an inner L-sectioned member spaced therefrom to define therebetween a pair of longitudinal recesses in each said strip into which the associated juxtaposed panel edges are received, the included angle between the flanges of each said strip when free of said panels being less than that maintained between its associated side panel and said first panel, and means for preventing separation between each said strip and its associated panels comprising a projecting longitudinal tongue on each said outer flange and a cooperating groove near each associated panel edge, each end of each said junction strip being mitered and in abutting relationship to an end of its adjoining strip so that said plurality of strips completely enframe said first panel in interlocking relationship with said panels and with each other.

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