Aug. 6, 1946. D. G. BLATTNER ET AL 2,405,180

INSULATOR

Filed March 4, 1944

FIG. 1

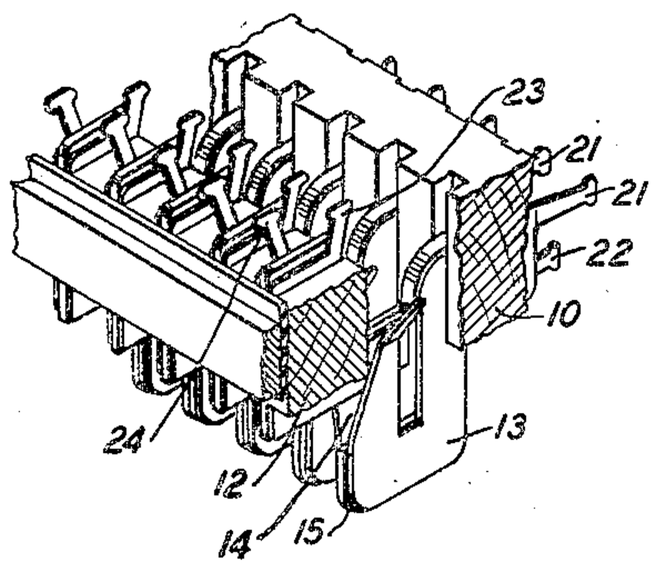


FIG. 4

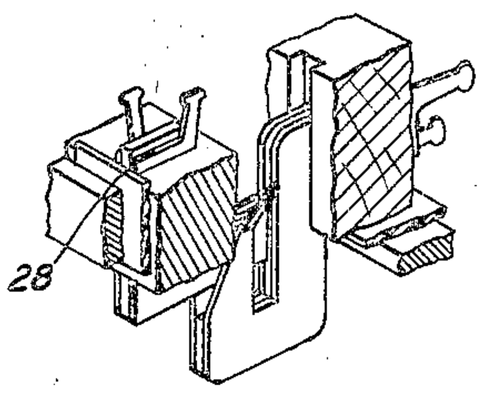


FIG. 2

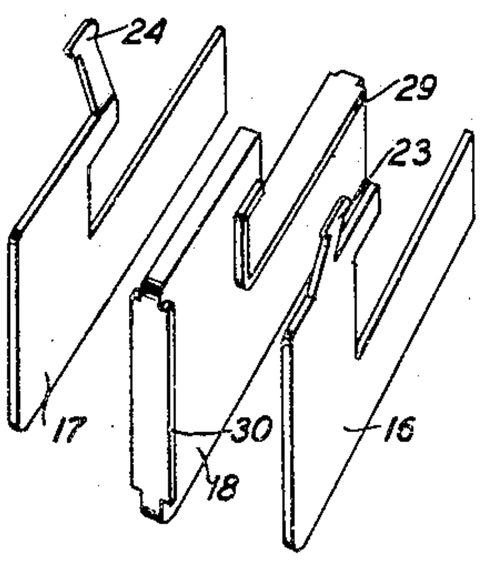
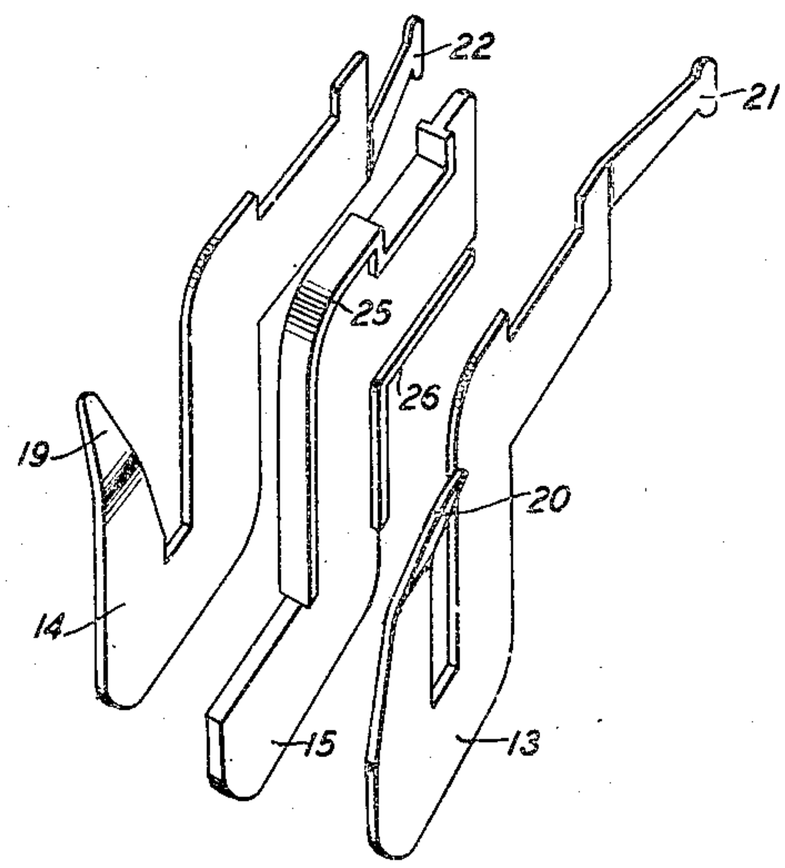


FIG. 3



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Patented Aug. 6, 1946 2,405,180

UNITED STATES PATENT OFFICE

2,405,180

INSULATOR

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Application March 4, 1944, Serial No. 525,114

5 Claims. (Cl. 173—328)

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This invention relates to insulators and particularly to insulating separators of the type employed extensively in electric circuit connectors of the jack and plug types.

One of the more serious problems encountered in the field of connectors for electric circuits is that produced by the breakdown of the insulating elements used to insulatively separate the metallic circuit terminal elements. Usually, in jack and plug type connectors, the metallic terminal elements, or springs, are arranged in substantial alignment and spaced one from another by an insulating separator, and the entire assembly, consisting of alternate conducting and insulating elements is mounted in any suitable manner on a support, with the plug connector movable into and out of engagement with the jack connector. Such assemblies are frequently subjected to high humidity and temperature conditions resulting in condensation of moisture which collects on the edges of the insulators causing deterioration of the insulator and providing relatively low resistance leakage paths between the metallic springs.

Heretofore, insulators of the type referred to have been stamped or punched from sheets of phenol fibre, or other similar insulating material, so as to conform, substantially, in size and shape to the conducting springs between which they are located. The leakage path between the metallic terminals, or spring separated by such insulators corresponds in length to the thickness of the insulator at its edges. To provide an adequately long leakage path and one which would minimize the probability of insulator breakdown necessitates the use of insulators having appreciable thickness which, in turn, limits the number of conducting terminals which may be accommodated on a support of given length. Furthermore, the stamping or punching process resorted to in forming such insulators produces rough peripheral edges which provides pockets, or crevices in which moisture readily collects.

It is the object of this invention to provide an insulating separator which furnishes a relatively long leakage path between conducting springs without increasing the spacing between springs, and which reduces to a minimum the possibility of moisture vapor collecting in critical areas.

This object is attained in accordance with a feature of the invention by shaping the insulator to conform, in general, to the shape of the springs separated thereby, and by providing flanges extending laterally from the peripheral edges thereof which overlap the edges of the conducting springs in critical areas and thereby increase the leakage path for breakdown currents between springs.

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Another feature of the invention contemplates molded insulators which present smooth surfaces to the surrounding atmosphere and thereby, not only preclude the collection of moisture vapors on the peripheral edges of the insulators but facilitate the flow of such moisture therefrom.

These and other features of the invention will be readily understood from the following detailed description when read in connection with the accompanying drawing, in which:

Fig. 1 is a perspective view of cooperating connectors of the jack and plug types used extensively in the telephone plant and which embody the insulators of the present invention;

Fig. 2 is an enlarged exploded perspective of the two conducting elements of a plug type connector and an interposed insulator embodying the features of the invention;

Fig. 3 is a view similar to that of Fig. 1 except that the elements of a jack type connector are illustrated; and

Fig. 4 is a partial perspective view similar to that of Fig. 1 except that it illustrates jack and plug type connectors of the prior art.

In Fig. 1 are shown two mounting blocks **10** and **12**, the former being notched at regularly spaced intervals to accommodate a plurality of sets of jack type connector elements, each set consisting of two jack springs **13**, **14** and an interposed insulating separator **15**; and the latter being similarly notched to accommodate a plurality of sets of plug type connector elements, each set consisting of two plug springs **16**, **17** and an interposed insulator **18**. It is deemed unnecessary to elaborate on the structural characteristics of the mounting blocks **10** and **12** since they are well known in the art, and are used extensively in the telephone plant in connection, particularly, with step-by-step switching apparatus.

As shown more clearly in Fig. 3, the forward ends of the jack springs **13** and **14** are flared at **19** and **20** so as to readily permit the insertion of the plug connector therebetween as shown in Fig. 1. The rear ends of the jack springs **13** and **14** are provided with terminal tabs **21** and **22** to which circuit conductors may be secured in any well-known manner, such as by soldering, for example. Similar terminal tabs **23** and **24** are integrally formed on the plug springs **16** and **17**, respectively, for the same purpose.

Each of the jack spring separators **15** is individually molded of a suitable thermoplastic insu-

lating material preferably by the well-known injection molding process, though any other suitable molding process may be resorted to. It will be observed particularly by reference to Fig. 1, that the insulator 15 has such dimensions relative to the dimensions of the jack springs 13 and 14 between which it is located, that it extends beyond the edges of the metal part in all directions so as to increase the leakage paths for the breakdown currents. The jack insulator 15 as clearly shown in Fig. 3 is provided with an integral flange 25 which projects in both directions from the main body portion of the insulator at the upper horizontal and outer vertical edges while corresponding lower horizontal and inner vertical edges are provided with an integral flange 26 which extends laterally from the main body portion of the insulator in both directions. The flanges 25 and 26 on either side of the insulator 15, while serving to materially increase the leakage paths between complemental springs 13 and 14 when assembled, also provide means for accurately positioning the springs in the assembly since the area confined between any two flanges 25, 26 corresponds in size and shape to the size and shape of that corresponding portion of the spring, so that when the two complemental springs 13 and 14 are fitted within the flanges on either side of the insulator they automatically assume positions of accurate alignment. The minimum leakage path between the upper edges of springs 14 and 13 furnished by such flanges obviously has a length equal to twice the flange thickness measured vertically in Fig. 3, plus the over-all width which may be substantially greater than the thickness of the body portion of the insulator. Furthermore the outer peripheral edge of the insulator is smooth due to the molding process by which the insulator is formed and thereby does not present any rough edges which provide pockets or crevices for the collection of moisture. Similarly, the grooves presented at the line of contact of the upper edges of the springs with the face of the interposed insulator of the old type as shown in Fig. 4 and identified therein by the numeral 23 are entirely protected, thereby further minimizing the possibility of the collection of moisture at this critical area. The flange 26 serves similar purposes with respect to the lower or under edges of the assembly. It is apparent that with the insulator design illustrated, all critical areas are protected against the possibility of moisture collection by relatively long leakage paths for breakdown currents. It is also apparent that such advantages have been gained without any increase in the thickness of the body portion of the insulator, or in the total thickness of an assembly comprising two terminal springs and their interposed insulator.

The plug insulator 13 also extends beyond the edges of the springs 16 and 17 and is provided with integrally formed flanges 29 and 30 which obviously serve the same purpose as do the flanges 25 and 26 of the jack insulator 15.

The insulator design of this invention, aside from its effectiveness in minimizing insulator breakdown by increasing the leakage paths for the breakdown currents and precluding the collection of moisture in critical areas, also insures an accurate alignment of the several members of the connector assembly; prevents relative shifting thereof during and after assembly; simplifies the assembling of such members; and provides a much neater and more durable insulator than has heretofore been devised.

While the insulator of the present invention has been disclosed in its particular application to plug and jack type connectors of the type employed in the telephone plant in connection with step-by-step switching apparatus, it is to be understood that it is applicable to other types of connectors and spring pile-ups requiring effective electrical isolation of complemental, or closely associated spring type terminals.

It will be noted with reference to Fig. 4, which illustrates jack and plug type connectors of known design, that the length of the leakage path for breakdown currents between complemental springs is substantially the thickness of the interposed insulator. Furthermore, the insulators of such connectors are punched or otherwise cut from sheets of insulating material which leaves the peripheral edges of the insulator rough and uneven thereby encouraging the collection of moisture on the edges between springs and contributing to the cause of insulator breakdown. It will be noted also that the spring and interposed insulator edges are all exposed to the surrounding atmosphere so that moisture vapors will collect in the grooves appearing between adjacent spring and insulator elements as well as in the crevices and irregularities of the insulator edges caused by the punching process. The insulator of the present invention overcomes all these undesirable features which are characteristic of insulators of the prior art, such as shown, by way of example, in Fig. 4.

What is claimed is:

1. A spring pile-up comprising two conducting elements and an insulating element arranged alternately in contiguous relation and each including two right angularly disposed integral sections, and means for insuring an accurate alignment of said elements comprising shelf-like flanges extending laterally from the edges of the right angularly disposed sections of the insulating element in opposite directions, and defining a recessed area on each of the opposite faces of the insulating element corresponding in size and shape to that of the right angularly disposed integral sections of the conducting elements.

2. A spring pile-up in accordance with the preceding claim in which the said flanges provide a leakage path for breakdown currents between the conducting elements greater than the combined thicknesses of the three elements of the pile-up.

3. An electric terminal assembly comprising in combination, a pair of similar flat type springs each consisting of at least two integrally formed right angularly disposed substantially rectangular sections occupying a common plane, two of whose edges are joined by a continuous arcuate section, and a molded insulator interposed between said springs and comprising two integrally formed right angularly disposed sections of the same shape as the angularly disposed sections of said springs and making surface contact with corresponding sections of said springs so that the edges thereof are in alignment with corresponding edges of said spring sections when said springs and insulators are in assembled relation, and means for insuring the alignment of the edges of the sections of said springs and insulator and for precluding relative shifting of said springs and insulator comprising integral flanges on the upper and lower edges of the sections of said insulator extending laterally in either direction therefrom to define, on each side of said insulator, a recessed area corresponding

in shape and depth to the shape and thickness of the right angularly disposed sections of said springs, one of said flanges including an arcuate section conforming to the contour of the arcuate edge sections of said springs.

4. An electric circuit terminal assembly comprising in combination a pair of similarly shaped flat type springs each of which consists of a main body portion having integral sections thereof relatively disposed at substantially right angles, and a molded insulator interposed therebetween, said insulator having a main body portion comprising integral sections thereof relatively disposed at right angles, the right angularly disposed sections of said springs corresponding dimensionally and making surface contact with opposite sides of the right angularly disposed sections of said insulator, and said insulator being provided with integral flanges extending outwardly in either direction from the edges of the right angularly disposed sections thereof to define, on each side of said insulator, a recessed area corresponding in shape and depth to the shape and thickness of the right angularly disposed sections of said springs whereby said

springs and said insulator, when mounted in assembled relation are incapable of relative movement in the longitudinal directions of their right angularly disposed sections.

5. In combination, a flat type spring comprising two substantially rectangular integrally formed angularly disposed sections located in the same plane, and a flat type insulator having two integrally formed angularly disposed sections of substantially the same shape as the sections of said spring adapted to make surface contact with corresponding surfaces of said spring sections, with the edges of said insulator and spring sections in alignment when said insulator and spring are in assembled relation and means for preventing any movement of said spring in the plane thereof relative to said insulator comprising flanges integrally formed on said insulator and extending laterally from each of the edges of the angularly disposed sections thereof so as to overlap corresponding edges of the angularly disposed sections of said spring.

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