A terminal block comprises a thermoplastic body and a plurality of jumper bars. Each jumper bar has end portions with tubular projections that define holes in the jumper bar through which conductor-retaining screws are inserted. Each projection terminates in a radially outwardly extending locking ring. The jumper bar is secured to the terminal block with the projections embedded therein whereby the retaining ring on each projection locks with the plastic of the body. The process for attaching the jumper bar to the body utilizes the application of axial pressure to the jumper bar while at the same time applying axial vibratory forces at a sufficient frequency to cause the plastic to flow around the retaining rings and lock therewith.

3 Claims, 8 Drawing Figures
TERMINAL BLOCK AND METHOD OF MAKING THE SAME

BACKGROUND OF THE INVENTION

This invention relates to electrical terminal blocks and to methods of making the same.

In the manufacture of terminal blocks having a series of jumper bars, it is desirable that the jumper bars be firmly secured to the insulating body of the terminal block in an economical and practical manner. The present art accomplishes this in various ways, for instance, by riveting the jumper bars to the plastic or by the use of other discrete retaining devices.

OBJECTS AND SUMMARY OF THE INVENTION

An object of this invention is to provide a novel method of securing a jumper bar to the plastic body of a terminal block.

A further object of this invention is to provide a new terminal block that is of simple and economical construction and wherein the jumper bars are positively retained on the plastic body of the terminal block.

A further and more specific object of this invention is to provide a device and method of the type stated in which the jumper bars are embedded in the plastic of the terminal block by vibratory welding techniques that cause the plastic of the block to flow into locking relationship with specially formed projections on the jumper bars.

In accordance with the objects of this invention the invention comprises a thermoplastic terminal block body having a base with spaced parallel ribs, each rib having a series of holes in such that there is provided opposed pairs of holes with one hole of each pair being in one rib and the other hole of the pair being in the other rib. An electrically conductive jumper bar spans the space between the ribs and has openings substantially coaxial respectively with the holes. The portions of the jumper bar defining the openings therein have tubular projections with radially outwardly turned retaining rings. In assembling the jumper bar with the plastic body of the block, the radial projections are placed in approximate coaxial alignment with the respective holes in the plastic and with the retaining rings abutting the plastic. Axial pressure is applied to the projections through a horn to urge the projections against the plastic while at the same time vibratory forces are applied through the horn to the jumper bar and the plastic. The pressure and vibrations cause the plastic to flow and allow the projections to penetrate the plastic so that when the plastic stops flowing upon cessation of the pressure and vibrations, the plastic will be fused on opposite axial sides of the retaining rings. Thereafter, the projections and their associated holes in the plastic may be threaded for receiving fastening screws for use in securing conductors to the terminal block.

The attainment of the above and further objects of this invention will be apparent from the following detailed description taken in conjunction with the accompanying drawing forming a part thereof.

BRIEF DESCRIPTION OF THE FIGURES

In the drawing:

FIG. 1 is a perspective view of a jumper bar constructed in accordance with and embodying the present invention;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a top plan view of a terminal block in accordance with the present invention;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary sectional view and showing the jumper bar in position preparatory to being assembled with the block;

FIG. 6 is a fragmentary sectional view of a portion of the jumper bar and block and showing the two assembled;

FIG. 7 is a fragmentary sectional view similar to FIG. 3 after the horn for the conductor-retaining screw has been threaded; and

FIG. 8 is a fragmentary elevational view, partially diagrammatic, of apparatus for securing two jumper bars to the block at one time.

DETAILED DESCRIPTION

Referring now in more detail to the drawing, which illustrates a preferred embodiment of the present invention, there is shown a terminal block 2 that is molded of a suitable thermoplastic resin. The terminal block 2 is of generally rectangular configuration and comprises a base 4 having spaced apart parallel ribs 6, 8 projecting from the base 4 and defining a channel 10 therebetwehen. At its transverse end, the base 4 has upstanding generally rectangular bosses 12, 14 having holes 13, 15 through which mounting screws may be passed to mount the block 2 in its operative position.

Each rib 6, 8 has a series of spaced apart holes 16, 18 running generally perpendicular to the base 4. The spacing of the holes 16, 18 in the respective ribs 6, 8 provide a series of opposed pairs of holes with one hole 16 of each pair being in one rib 6 and the other hole 18 of the pair being in the other rib 8. The line joining the centers of the holes is generally perpendicular to the longitudinal extents of the ribs 6, 8. Between each pair of holes 16, 18 the base is integrally formed with transversely extending outwardly projecting fins 20 that serve to provide electrical isolation between the various sections of the terminal block.

A plurality of flat jumper bars 22 are mounted on the terminal block between the fins 20. Each jumper bar 22 comprises a central piece 24 and generally circular ends 26, 26. The central piece 24 may include an integral threaded flange 28 that defines a hole 30. The provision of the hole 30 is optional, but when so provided may receive a screw (not shown) for electrically connecting two or more adjacent jumper bars 22 together through a short circuiting strip 32. The short circuiting strip 32, when included as part of the terminal block, may be secured by screws 34 that are threaded into fins 20. Relief notches 36 may be provided in the fins for accommodating the short circuiting strip 32.

The circular ends 26, 26 are integrally formed with tubular axial projections 38, 38 that terminate in radially outwardly flared retaining rings 40, 40. Thus, the axial projections 38, 38 define openings 42, 42 which are coaxial with the respective holes 16, 18. As shown in FIGS. 4 and 7, the openings 42 and their associated holes in the ribs 6, 8 are threaded for receiving screws 44 and by which electrical conductors are secured to the jumper bars.

In assembling the jumper bars with the plastic of the terminal block, each jumper bar 22 is placed on top of the ribs 6, 8 such that the openings 42, 42 are substantially aligned with the respective holes 16, 18 and with the edges of the respective retaining rings 40, 40 abutting the ribs 6, 8. The jumper bars 22 may be individually attached to the plastic, but preferably they are attached two at a time by a variation transmitting member or horn 50. The horn 50 has four downwardly projecting fingers 52 which are sized at their tips for applying localized axial pressure against the projections 38 in the direction toward the ribs 6, 8. The horn 50 forms part of a known apparatus that includes a source 54 for generation of vibrations in the range of between about 1,000 cycles per second and 100,000 cycles per second. Such vibrations may transmit an amplitude in a direction generally of the fingers 52 and projections 38 of the order of 0.001 to 0.01 inches. Vibration transmitting apparatus of the foregoing type is known and is shown, for example, in Balamuth et al. U.S. Pat. No. 3,184,353, and to which reference may be had.

As axial pressure is applied by fingers 52 and while simultaneously thereof axial vibratory forces are transmitted from the fingers 52 through the jumper bar 22 and to the plastic of the ribs 6, 8, the projections 38, 38 are pressed into the ribs 6, 8. The vibration-applying apparatus has an adjustment for the frequency of vibration of the horn 50 and other mass of the apparatus that vibrates therewith, whereby the resonant frequency of the vibrating unit may be selected for the jumper bar securing process. The vibration-applying and applied pressure causes the plastic to flow around the retaining rings 40, as shown in FIGS. 6 and 7. When the vibratory forces and the pressure of the fingers 52 on the jumper bar are removed, the
plastic fuses with the projections 38 and the retaining rings 40 lock the jumper bars 22 in position on the ribs 6, 8. The plastic does not change its physical properties whereby its strength around the retaining rings 40 is not impaired.

Upon completion of attachment of the jumper bar, the holes at 16, 42 (FIG. 7) may be threaded in a conventional manner for receiving the screws 44.

While a preferred embodiment of the present invention is herein shown and described, it should be understood that the invention is not limited thereto as various changes and modifications within the scope of the appended claims may be made without departing from the invention.

The invention is claimed as follows:

1. A terminal block comprising a thermoplastic body having a base with spaced parallel ribs projecting therefrom and defining said base a channel between said ribs, a plurality of spaced apart holes in said ribs running generally perpendicular to said base, the spacing of the holes in said ribs providing a series of opposed pairs of holes with one hole of each pair being in one rib and the other hole of the pair being in the other rib, the line joining the centers of the holes of each pair running generally perpendicular to said ribs and spanning said channel, a fin projecting from said ribs and spanning the channel generally perpendicular to said ribs and intermediate adjacent pairs of holes for providing electrical isolation between adjacent pairs of holes, an electrically conductive jumper bar spanning the channel and seated on said ribs adjacent to said fin, said jumper bar having openings substantially coaxial respectively with a pair of said holes, said openings and said holes being threaded for receiving screws by which conductors are electrically connected to said jumper bar, said jumper bar having axial projections surrounding the respective openings and with each axial projection having a radially outwardly turned retaining ring, each said projection and retaining ring thereon being embedded in a rib with the plastic of the rib being a homogeneous mass on opposite axial sides of said retaining ring.

2. A terminal block according to claim 1 in which said plastic is flowed around each said axial projection by pressure and vibratory energy applied to said ribs through said jumper bar.

3. In a terminal block, a thermoplastic body having spaced apart holes therein, and electrically conductive jumper bar spanning the space between said holes, said jumper bar having openings at said holes respectively, the openings and holes being threaded for receiving a fastener to connect conductors to said jumper bar, said jumper bar having axial projections surrounding the respective openings, said projections each including a radially turned retaining element, each projection and retaining element thereon having been embedded in the plastic of said body by pressure and vibratory energy applied to said jumper bar.

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