Feb. 15, 1966 S. N. BUCHANAN ETAL 3,235,832

SOLDERLESS MULTI-TERMINAL PLUGS AND METHOD OF CONNECTING WIRES THERETO

Filed July 27, 1962 3 Sheets-Sheet 1

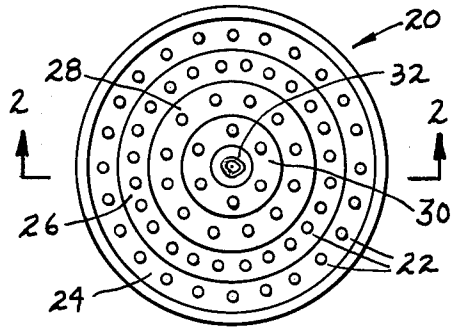


FIG. 1

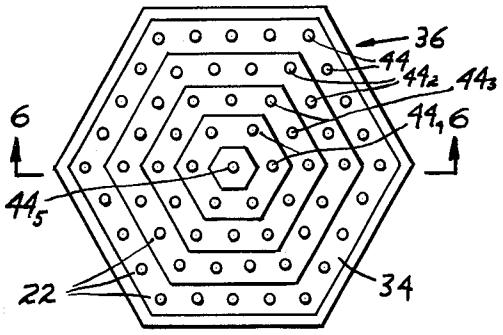
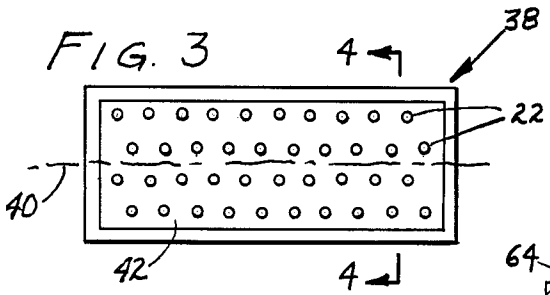


FIG. 5

FIG. 3



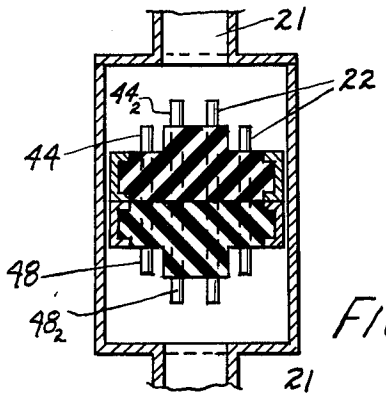


FIG. 4

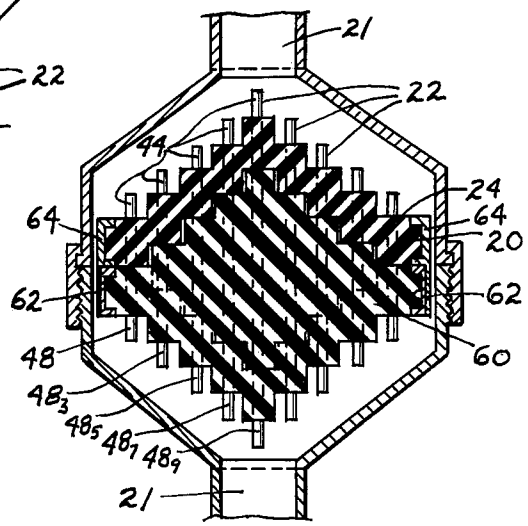
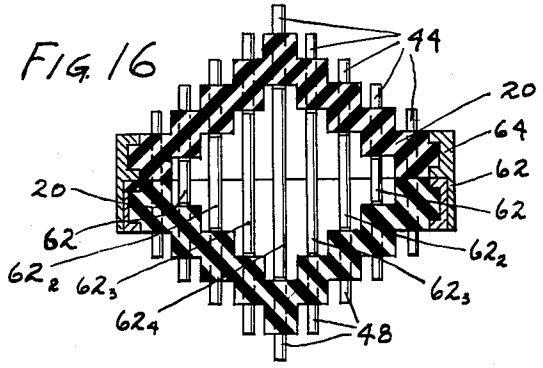


FIG. 2

FIG. 16



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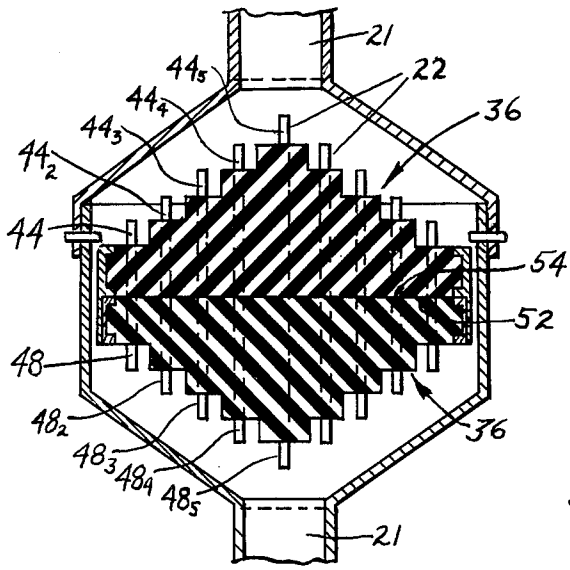


FIG. 6

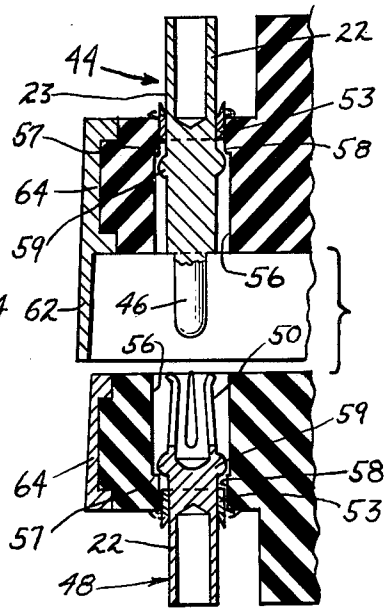


FIG. 7

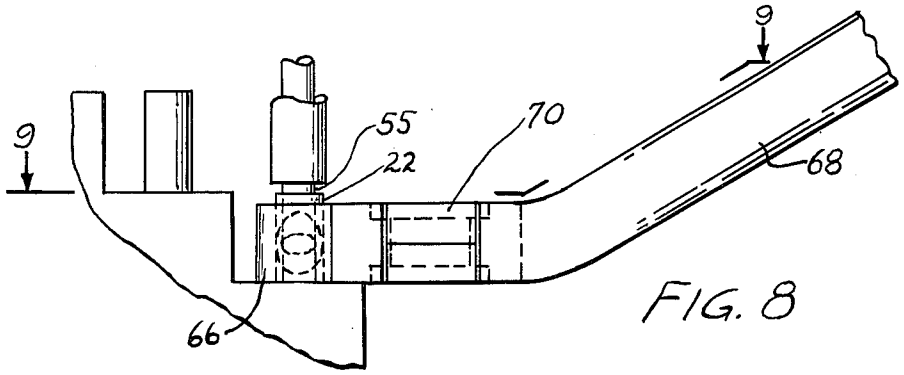


FIG. 8

FIG. 9

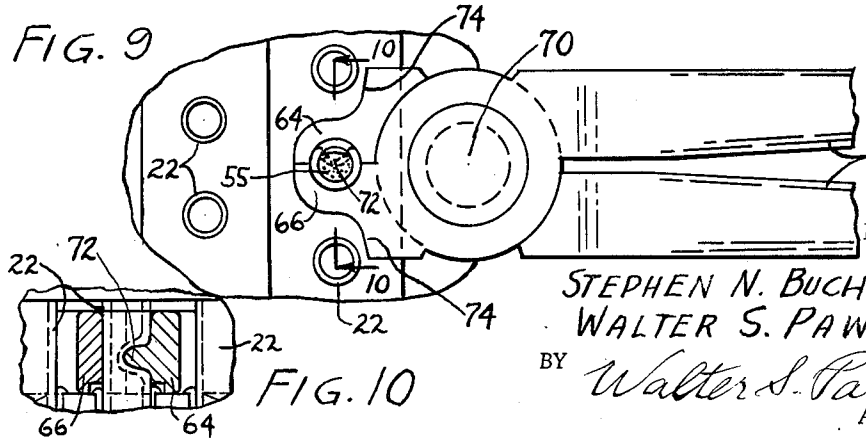


FIG. 10

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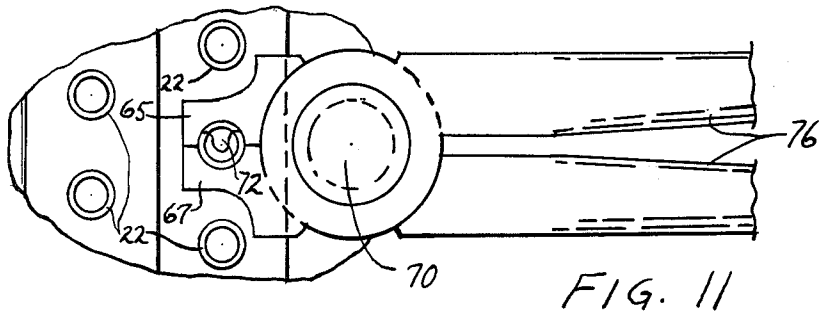


FIG. 11

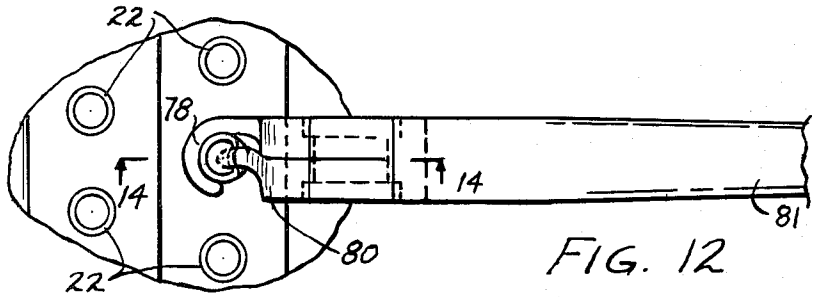


FIG. 12

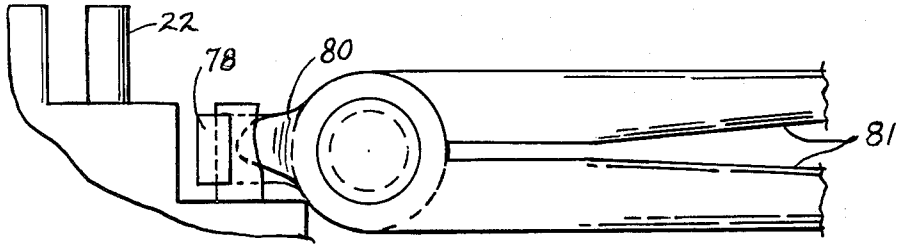


FIG. 13

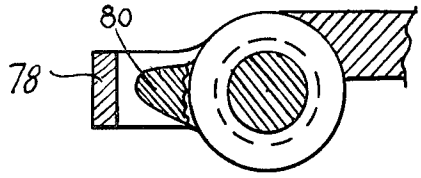


FIG. 14

FIG. 15

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SOLDERLESS MULTI-TERMINAL PLUGS AND METHOD OF CONNECTING WIRES THERETO

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Filed July 27, 1962, Ser. No. 212,867
5 Claims. (Cl. 339—64)

This invention relates to the construction of multi-terminal plugs and methods of solderless connection of the wires to these terminals and tools therefor.

The object of this invention is to eliminate the soldering of wires to the terminals of multi-terminal plugs by stepping the terminal blocks of these plugs on their wire terminal faces so as to raise the bases of the protruding terminal ends in each succeeding row behind the outer row, to the level of the top of the ends in the row in front of it, thus providing easy access to each row of terminal ends from the outer side of the block, with a special tool for fixing the wire in each terminal.

A further object is thus to pyramid the rows of terminal ends in a symmetrical pattern about the center of circular or polygonal blocks and about the longitudinal axis of oblong blocks.

A further object is to correspondingly step the plug face of a block inwardly so as to enable the use of terminals of the same length in all the rows of the block in one block, preferably the male plug block, to provide a protective hollow for the protruding male plugs, in which hollow the male plugs are protected against damage in handling, the female plug block being pyramided outwardly to fit into this hollow for connection of the protruding male plugs with the hollow female plugs which are set in o the faces of the steps of the femal plug block.

A further object is to make both blocks inwardly stepped on their adjacent faces, so as to be able to use the same length of terminals in all the rows in each block, and provide light insulated extension rods of various lengths on the plugs of one block for connection with the plugs in the other plug block, thus eliminating the weight of the mass of block material that these lightly insulated rods, displace in this form of terminal plug.

A further object is to use a tool with jaws that will fit around a wire terminal end with sufficient clearance to be brought down over one such end in relatively opened condition and then closed around this tubular end in which a wire has been inserted, in order to dent the tube at one side tightly into the wire for a strong high-pressure contact.

A further object is to use the terminal ends on both sides of the one being dented, as guides for corresponding shoulders on the tool jaws, to facilitate centering the jaws over the end to be dented.

Other and more specific objects will appear in the following detailed description of the invention as illustrated in the several views of the drawings, wherein:

FIG. 1 is a face view of a circular terminal block made in accordance with the present invention,

FIG. 2 is a cross-sectional view of a plug assembly as taken on the line 2—2 of FIG. 1,

FIGS. 3 and 4 are similar views of a rectangular terminal block,

FIGS. 5 and 6 are similar views of a polygonal terminal block,

FIG. 7 is a sectional view of male and female block plug terminals,

FIG. 8 shows in side elevation a denting tool applied to a wire terminal,

FIG. 9 is a plan view of the same assembly,

FIG. 10 is a sectional view through the jaws taken on the line 10—10 of FIG. 9,

FIG. 11 is a plan view of another form of denting tool being applied to a terminal tube,

FIG. 12 is a different form of tool similarly applied,

FIG. 13 is a side view thereof,

FIG. 14 is a detail sectional view of the tool jaws taken on the line 14—14 in FIG. 12,

FIG. 15 is a side view of the same tool with the handles angularly offset from the jaws for more convenient operation over the steps of the block, and

FIG. 16 is a section similar to FIG. 2 of a portion of a modified form of blocks, using insulated conductor pins extending through the hollow space between the plugs to connect the respective terminal plugs together when the plug connection is made.

The present plug blocks may take any form crosswise and are formed with steps for each successive row of terminals back of the outer row toward the center of the block. FIG. 1 shows a distribution pattern of rows in a circular block **20**, where the circumferential or outer row of terminal ends **22** extends from the lowest step **24**, the successive rows back to this row toward the center of the block extending from steps **26**, **28**, **30** and **32**, which are each substantially at the level of the top of the terminal ends **22** in the row in front of it.

A similarly stepped conformation raises the successively shorter rows of terminal ends **22** back of the peripherally outer row **34**, in the polygonal form of plug block **36** shown in FIGS. 5 and 6.

In the rectangular form **38** shown in FIGS. 3 and 4, the successive rows back of the outer rows **42** of terminal ends **22** toward the longitudinal axis **40** extend from steps raised substantially to the top of the terminal ends **22** in the preceding rows.

Quick disconnect casings may be provided of any well-known types, or as illustrated in section in FIGS. 2, 4 and 6, having cable openings **21**.

The terminal pins **44** with male plug ends **46** and the terminal pins **48** with female plug ends **50**, used in the outer rows in any form of block may be made of a standard short shank length as shown in enlarged sectional view in FIG. 7. Each pin **44** and **48** is provided with a wire terminal end **22** in the outer row of terminal ends of each block.

In the form of blocks shown in FIG. 6, the terminal pins having wire terminal ends **22** in the successively raised steps toward the center of the blocks have correspondingly longer shanks. Terminal pins 44_2, 44_3, 44_4 and 44_5 having male plug ends mating with the alined female plug ends of terminals pins 48_2, 48_3, 48_4 and 48_5, respectively, in opposed flat plug faces **52** and **54** of the blocks **36**.

While a tubular end is shown as the wire terminal end **22** of the terminal pins here illustrated, adapted for receiving the bared end of a wire **55**, any other suitable form of wire terminal ends may be formed on these terminal pins. The purpose of stepping the rows of terminal ends is to facilitate the fixing of the wires to the terminal ends by making them more accessible than they have been in the prior art. The stepping of the rows furthermore provides an increased insulator surface distance between pins, so

that the lateral spacing may be considerably reduced without danger of surface current leakage between the pins, so that a more compact plug block may now be made for the required number of terminal pins in the block.

The plug end faces **52** and **54** have substantially identical counterbore pockets **56** in the oversize bores **58** through the block for loosely receiving the shanks of the terminal pins. The lengths of these bores **58** correspond to the thickness of the block at the several steps of the block.

To provide some protection of the protruding male plug ends when the blocks are disconnected, the block **20** has its male plug face stepped inwardly, forming a protective hollow for the male plug ends, the outer row of these ends being surrounded by the peripheral shoulder **62** on the reinforcing collar **64**. The terminal pins **44** are all of the same minimum length. The mating plug block **60** is stepped outwardly to fit into the hollow inwardly stepped plug end face of block **20**. Block **60** requires a different length of terminal pins for the different steps of the block, viz. pins 48_3, 48_5, 48_7 and 48_9.

The terminal pins have a loose fit in the bores **58** for limited lateral adjustment at their plug ends to facilitate alignment of corresponding plug ends when plugging blocks together. Counterbores **56** in the plug faces of each block provide pockets forming shoulders **57** against which an upset ridge **59** on the pins is engaged, upon assembly of each pin as its wire terminal end **22** is passed through the bore **58**, and the outer edges of a collar **53** fixed at the proper place on the pin, is swayed outwardly to fit loosely over the end of bore **58**, as shown in dotted lines in FIG. 7.

In order to lighten the weight of block **60**, it may be hollowed out by inward steps like block **20**, as shown in FIG. 16, and insulated extension plug pins **62**, 62_2, 62_3 and 62_4 are used in this case, between the corresponding terminal pins **44** and **48**. These extension plug pins are each provided with a male plug end **46** and a female plug end **50**, and the insulating tubes are counterbored at their ends to form pockets **56** for the plug ends **46** and **50**.

The terminal ends **2** are tubular and are provided with peep holes **23** for inspection when inserting a wire, to see that it is fully pushed in before denting the tubular end over into the side of the wire.

The tool for fixing the wire in the tubular end is provided with a pair of jaws **64** and **66** adapted to fit around a tubular end **22** and having plier handles **68** pivoted at **70**. One of the jaws has an inwardly protruding edge **72** for pressing into one side of the tubular end **22** as the jaws are moved together around the end **22**, thus denting the tubular end in with the high leverage provided by the short jaws to depress the dent firmly into the side of the wire **55**. The jaws are provided with guide shoulders **74** for sliding against the adjacent tubular ends to guide the jaws over the end **22** between them, and the denting protrusion is brought to the proper level of the tubular end **22**, when the jaws of the tool are brought down flush on the face of the block. The handles **68** are angularly formed to extend upwardly from the plane of the jaws, to facilitate working from the top of the tubular ends, as shown in FIGS. 8 and 9.

The tool may take other forms. FIG. 11 illustrates a form similar to that shown in FIGS. 8 and 9 but for the handles **76** which are in the same plane with the jaws **65** and **67**.

The jaws **78** and **80** in the tools illustrated in FIGS. 12 to 15 are operated by handles **81** in the vertical plane, the hooked jaw **78** being lowered behind the tubular end **22** with the jaws open, and as they are closed the cam jaw **80** dents the near side of the tubular end **22** in against a wire that is inserted therein for a high pressure contact therewith.

The handles **82** in FIG. 15 extend at an angle upwardly from the plane of the block face, to facilitate using the tool from the top of the tubular ends **22**.

Many obvious modifications in the form and arrangement of parts of the present blocks may be made without departing from the spirit and scope of the present invention, as defined in the appended claims.

What is claimed is:

1. A wire terminal plug comprising a terminal plug block having a wire terminal face having a stepped configuration defining a series of raised ledges, a plurality of terminal plug elements mounted in said plug block and having a terminal end extending out of said raised ledges for receiving the end of a wire and adapted to have the wire fixed thereto, the terminal ends in a lower ledge extending only to the level of the next higher ledge, said terminal plug elements extending through the terminal plug block, said terminal plug block having a plug face, the plug face being flat, each plug element having a plug end at the plug face of said block adapted to be connected to a mating plug element of a terminal plug element in a mating terminal plug.

2. A wire terminal plug as claimed in claim **1** in which said terminal plug block has a plurality of bores therethrough corresponding in number to the number of terminal plug plug elements, each bore having a smaller diameter portion and a larger diameter portion defining a shoulder therebetween, and each terminal plug element having an enlarged portion thereon abutting against said shoulder and having a flange fitted tightly thereon and bent over and in engagement with the face of said terminal plug block out of which the smaller diameter portion of said bore opens for mounting said terminal plug element in said bore for permitting movement of the ends of said plug element laterally of the bore.

3. A wire terminal plug comprising a terminal plug block having a wire terminal face having a stepped configuration defining a series of raised ledges, a plurality of terminal plug elements mounted in said plug block and having a terminal end extending out of said raised ledges for receiving the end of a wire and adapted to have the wire fixed thereto, the terminal ends in a lower ledge extending only to the level of the next higher ledge, said terminal plug elements extending through the terminal plug block, said terminal plug block having a plug face, the plug face having an inwardly stepped face corresponding to the stepped configuration of the wire terminal face, the terminal plugs in all of the ledges being the same length, each plug element having a plug end at the plug face of said block adapted to be connected to a mating plug element of a terminal plug element in a mating terminal plug.

4. A wire terminal plug as claimed in claim **3** and a plurality of extension pins equal in number to the number of terminal plug elements in the recessed portion of said plug block said extension pins having ends complementary to the plug ends of the terminal plug elements in said plug face, said extension pins being adapted to connect with corresponding plug ends in an opposing plug block having the same configuration as said plug block.

5. A wire terminal plug comprising a terminal plug block having a wire terminal face having a stepped configuration defining a series of raised ledges, a plurality of terminal plug elements mounted in said plug block and having a terminal end extending out of said raised ledges for receiving the end of a wire and adapted to have the wire fixed thereto, the terminal ends in a lower ledge extending only to the level of the next higher ledge, said terminal plug elements extending through the terminal plug block, said terminal plug block having a plug face, the plug face having an outwardly stepped face adapted to mate with an inwardly stepped plug face having an inwardly stepped plug face with a corresponding stepped shape, each plug element having a plug end at the plug face of said block adapted to be connected

to a mating plug element of a terminal plug element in a mating terminal plug.

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