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(54) Cordage terminated by modular plug having enhanced terminal to conductor engagement.

(57) A length of cordage is terminated by a modular plug which includes a plurality of blade-like terminals (42,42). Each terminal includes two spaced tangs (82,82) which when the terminal is seated in a housing of the plug are caused to engage electrically stranded metallic wire-like elements (29-29) or tinsel ribbons (27,27) which are wound helically about a filamentary plastic core (25) of a conductor of a cordage 21. In order to enhance the integrity of the tinsel conductors and their contact with the terminals, the tangs are spaced apart a distance which differs from the lay length of the ribbons. Also, in order to enhance the probability of sustained electrical contact between the tangs and either stranded or tinsel ribbon conductors, the width of the portion each tang in engagement with the electrically conductive portion of an aligned associated conductor as measured in a direction along the length of the conductor is substantially less than in prior art terminals, thereby reducing the amount of the conductive portion of the aligned associated conductor which is penetrated when the terminal is inserted.

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Technical Field

This invention relates to cordage terminated by a modular plug having enhanced terminal to conductor engagement.

Background of the Invention

A conductor of a telephone cord which connects a telephone handset to a telephone base and in some instances a telephone base to a wall terminal generally comprises a polymeric core having a plurality of tinsel ribbons, i.e., typically three or four , wrapped helically thereabout. The tinsel conductors are covered with a suitable insulative covering such as hat, for example, which is disclosed and claimed in U. S. Patent 4,090,763 and in U.S. patent 4,705,823. For those cords which connect a telephone base to a wall terminal, each insulated conductor generally includes an elongated metallic member comprising a plurality of metallic wire-like members stranded together and insulated with a plastic material. A plurality of the individually insulated conductors are jacketed with a plasticized polyvinyl chloride (PVC) composition of matter.

In a commonly used cord connection arrangement, each end of a line or handset cord is terminated with a miniature plug, which is termed modular, to facilitate attachment to jacks in telephone instruments and in wall outlets. An end of a cord is inserted into one end of a modular plug and secured therein. The modular plug is adapted to be inserted into a cavity of a jack of a telephone, for example, or into a wall outlet to establish electrical connections between cord conductors which are terminated within the plug and contact elements in the form of wires in the jack. Modular plugs are disclosed, for example, in U. S. Patent Nos. 3,699,498 and 4,148,539.

Typically, a modular plug includes a plastic housing having conductor-receiving troughs which communicate with a cord-receiving opening at one end of the plug. An opposite end of the plug is referred to as a termination or free end. Terminal-receiving slots extend between the troughs and an outwardly facing inner surface of a well of the housing from which a plurality of partitions extend to an outer surface of the housing. Each slot opens to the inner surface of the well between two partitions or between a partition and a sidewall of the housing.

In one method of termination of a cord with a plug, the jacket is removed from an end portion of a length of cordage. That end portion is inserted into the cord-receiving end of the plug with end portions of the conductors being received in the plug troughs. Then the end portion of the length of cordage is secured within the plug and the plug is positioned in a nest to receive a plurality of terminals. Plated strips of terminals are fed into insertion apparatus such as is shown, for example, in U. S. Patent 3,839,787. Terminals are severed from the strips and seated within the terminal-receiving slots to engage electrically the cord conductors in the troughs. The slots are spaced to cause the seated terminals to engage the contact wires when the plug is inserted into a jack cavity and thereby connect electrically the cord conductors to the jack. In another method, cord conductors are inserted into an end of a plug housing having terminals preinserted thereinto. Then the terminals are moved farther into the housing, penetrating the conductors and becoming seated in the housing.

One prior terminal is described in abovementioned U. S. Patent 4,148,539. It is made from sheet stock of an electrically conductive material such as, for example, a Phosphor-bronze alloy. The terminal has flat major faces spaced apart by an edge surface which includes an internal contact portion comprising protruding tangs. When the terminals are seated fully within the plug housing, the tangs pierce the insulation of and engage electrically the conductors of the cord which has been inserted into the one end of the plug.

Each terminal also includes an external contact portion being exposed to an outer surface of the housing and having an outer surface which is spaced slightly from outer edge surfaces of the partitions which are coplanar with the outer surface of the housing. Each external contact portion includes an edge surface having a crown of a predetermined radius termed at each end thereof. The terminal is symmetrical with respect to an axis which extends through its center of gravity and which is normal to the edge surface of the external contact portion. That crown which is adjacent to the termination end of the plug housing functions to engage an aligned wire-like contact element of the jack into which the plug is inserted to complete an electrical connection from a conductor of the cord to the jack.

Each terminal also has barbs formed on opposed end surfaces thereof. The barbs support the terminals within the terminal-receiving slots to space the external contact portions above the inner surface of the well with the barbs being embedded in end walls which define the slots to prevent unintended movement of the terminals while each of the terminals is in a partially inserted position or when each is in a fully seated position.

In one flat blade-like terminal, an external contact portion of the blade has been reconfigured. Each terminal comprises a body portion which includes a reference surface that extends from one end of the terminal toward the other end. Each terminal also includes a fin-like portion having a curved leading edge surface which is adjacent to the termination end of the plug housing and a linear trailing edge surface that is normal to the reference edge surface. The external contact portion protrudes from the body portion and is disposed asymnetrically between the ends of the

body portion adjacent to the other end of the terminal.

Substantially the entire surface area of the hereinbefore-described terminal is covered with a base layer or layers of metallic material which provides corrosion resistance, smooths the terminal metal, and prevents diffusion of the terminal metal into a subsequently deposited layer of metallic material. The base layer is covered with a relatively thin layer of gold which is called a flash and which enhances a connection to a cord conductor. Also, selected surface areas of the external contact portion are covered with an additional layer of metallic material such as gold to enhance conductivity of the connection with a contact wire of the jack.

A terminal, such as one of those described hereinabove, is inserted into each slot of the housing such that an external contact portion of each is oriented toward the outer surface of the housing to which the partitions extend. The internal contact portion of the terminal establishes an electrical connection with a conductor of the cord that has been inserted into the housing prior to the insertion of the terminals. Of course, in the use of a plug having preinserted terminals, the terminals are preinserted prior to insertion of the cord conductors. The external contact portion of each terminal extends beyond the slot in which the terminal is seated and is adapted to make electrical engagement with a wire-like contact element of a jack when the plug is inserted into the cavity of the jack.

One of the problems which has manifested itself relates to the engagement of the tangs of the terminals with the tinsel or stranded conductors. Electrical opens have occurred, evidently because of a less than satisfactory sustained engagement. Also it has been found that disconnections have occurred when a cord which is terminated by a plug is pulled or moved in an oscillatory manner, for example.

Further, it has been found that because of the way in which tinsel ribbons are wound about the polymeric core, two of the ribbons may become stacked and aligned in a longitudinal plane with the third ribbon of a three ribbon conductor. As a result, it has been commonplace for the tangs of the terminals to penetrate simultaneously stacked portions of turns of two of the ribbons and the aligned portion of a turn of the third ribbon. This may cause the ribbons to become severed, resulting in electrical opens and interruptions to service. Also, gaps appear between successive stacks and adjacent turns of the third, single ribbon. Electrical opens also are caused because of tangs of the terminals engaging the conductors between adjacent ones of the turns of helically wound tinsel ribbons and possibly not engaging the ribbons.

What is needed and what seemingly is not available in the prior art is a modular plug having enhanced and maintained electrical engagement between the terminals thereof and a length of cordage which is terminated by the plug. The sought after modular plug should be one in which an arrangement for enhanced engagement is relatively inexpensive to implement.

Summary of the Invention

According to the invention, there is provided a modular plug which has enhanced terminal to conductor engagement as set out in Claim 1.

Brief Description of the Drawing

FIG. 1 is a perspective view of a portion of a telephone cord which comprises insulated tinsel conductors and which is terminated by a modular plug of this invention, the modular plug including terminals which provide enhanced and sustained electrical engagement of the terminals with conductors of the cord;

FIG. 2 is an elevational view in section of the modular plug which is shown in FIG. 1 with a terminal being positioned in a housing of the plug prior to being driven into seated engagement with an insulated conductor of the cord;

FIG. 3 depicts a stranded conductor of a cord which may be terminated by a plug of this invention;

FIG. 4 is an elevational view in section of a modular plug having terminals of the prior art with one of the terminals positioned to be seated fully;

FIG. 5 is an elevational view in section of the modular plug of FIG. 2 after the terminals have been seated fully in the plug;

FIGS. 6 and 7 are front elevational views of a terminal of this invention and one of the prior art, respectively, positioned for engaging an insulated cord conductor;

FIGS. 8 and 9 are plan views in section of tang portions of the terminal of this invention and one of the prior art aligned with an insulated cord conductor;

FIG. 10 is a simplified view which depicts a portion of a plastic core of a length of cordage with tinsel ribbons wound thereabout in one configuration and with a terminal shown in a preseated and in a seated position, the thickness of the tinsel ribbons being exaggerated for purposes of clarity;

FIGS. 11 and 12 are simplified views which depict a portion of a plastic core of a length of cordage with tinsel ribbons wound thereabout in configurations different from that of FIG. 10 and with terminals positioned for seating in a plug, the thicknesses of the ribbons being exaggerated for purposes of clarity;

FIGS. 13, 14, and 15 are side elevational views of terminals which have been used, which are used and which are in accordance with this invention, respectively; and

FIG. 16 shows an end view of a terminal with tangs thereof having been coined.

Detailed Description

Modular cord systems typically include cords 20-20 (see FIG. 1), each comprising a length of cordage 21 terminated at each end by a modular plug 23. The phrase "modular cord system" is intended to describe a system which includes the use of devices mounted in equipment and assembled to cord ends to facilitate customer connection of the cords to the equipment. The cordage 21 includes a plurality of individually insulated flexible conductors 22-22 (see FIG. 2). The cords are terminated with modular plugs 23-23 of the type shown, for example, in priorly mentioned U. S. Patent No. 4,148,539.

The construction of the cordage 21 is well known. The flexible conductor 22 may include a filamentary core 25 (see FIGS. 1 and 2) having a plurality of tinsel ribbons 27-27 wrapped helically thereabout and enclosed with a suitable insulative covering 28 such as that, for example, disclosed and claimed in hereinbefore identified U. S. Patent Nos. 4,090,763 and 4,705,823. In the alternative, a plurality of wire-like metallic conductors 29-29 (see FIG. 3) are stranded together and insulated with a plastic material 31 to provide an insulated conductor 32. The insulated conductors 22-22 may be disposed side-by-side in a planar array and are enclosed in a common jacket 34 (see FIG. 1) made of a suitable plastic material. The final cord configuration has a cross-section with parallel sides and semi-circular end and is referred to as a flat cord.

The cord 20 may be connected to a telephone hand set, to a telephone base, or to a wall terminal by inserting a plug 23 into a jack (not shown). The jack is typically that shown in U. S. Patent No. 3,990,764. The jack includes a cavity and a plurality of spaced-apart wire-like contact elements which protrude angularly into the cavity of the jack in which is received the modular plug.

As can be seen in FIGS. 1 and 2, the modular plug 23 constructed in accordance with the principles of this invention includes a housing 41 (see also FIG. 4), which is made from a dielectric material, and a plurality of terminals 42-42. The terminals 42-42 are destined to connect electrically the conductors 22-22 of the cord which are housed within the plug 23 and electrical components of telephone apparatus such as, for example, the wire-like contact elements of the jack. The terminals 42-42 are mounted within the housing 41 to be engagable by the contact wires in the jack.

The plug housing 41 is a unipartite rigid housing (see FIGS. 1, 2 and 4) made from a plastic material such as polycarbonate. The housing 41 includes a so-called free or termination end 46 which is closed. Further, the housing 41 includes a cord input end 47, a terminal-receiving side 48 and a side 49 opposite the terminal-receiving side. The cord input end 47 of the housing 41 is formed with a flared cord input aperture (not shown) which opens to a plurality of conductor-receiving troughs 56-56.

The conductor-receiving troughs 56-56 are constructed to provide a plurality of individual duct-like compartments which are disposed in one tier for receiving the conductors of a cord 20. They extend longitudinally from the vicinity of the free end 46. Each of the compartments is of sufficient size to accept one of the insulated conductors of the cordage 21.

An assembler removes a sufficient length of the cordage jacket 34 to permit insertion of the insulated conductors into the troughs 56-56. Then the assembler installs the jacketed portion of the cordage 21 into the cord-input aperture with the insulated conductors extending farther along into the troughs 56-56.

The plug 23 of this invention includes a plurality of partitions 61-61 (see FIG. 1). In the plug 23, the portion of each partition 61 which extends to and which is coplanar with the terminal-receiving side 48 may extend for only a fraction of the distance between the ends of a well 62 (see FIGS. 1 and 2). When a plug 23 is inserted into a jack, each wire-like contact member is received between adjacent ones of the partitions 61-61 adjacent to the free end of the plug or between a partition and a side-wall of the well 62.

Each terminal 42 is adapted to be received in a terminal-receiving slot 64-64 (see FIG. 2). Each of the terminal-receiving slots 64-64 opens to a surface 66 and connects the well 62 with an associated one of the conductor-receiving troughs 56-56. The terminal-receiving slots 64-64 extend parallel to the troughs 56-56 and include end walls 68 and 69. As can be seen in FIG. 2, the end walls 68 and 69 are oriented toward the free end 46 and the cord input end 47, respectively, of the housing 41.

Each of the terminals 42-42 is flat and blade-like and is made from a strip of an electrically conductive material such as, for example, brass or Phosphor-bronze alloy. As can best be seen in the drawings and particularly FIGS. 1 and 2 thereof, each terminal 42 includes a body portion 74 defined by flat faces 75-75 which are spaced apart by end edge surfaces 77 and 78. The end surfaces 77 and 78 are interrupted by cut-outs 79-79 to form shoulders 76-76. The terminal has an overall height of about 0.38 cm, an overall length of about 0.34 cm and a thickness of about 0.03 cm.

Internal contact portions in the form of triangularly shaped tangs 82-82 extend from a lower portion of the body 74 of the terminal 42. When the terminals 42-42 are seated fully within the housing 41 (see FIG. 5), the tangs 82-82 pierce through the insulation of and engage electrically the current carrying portions such as, for example, the tinsel ribbons of the insulated conductors 22-22. When the terminal 42 is in the fully seated position, the tangs 82-82 extend through an

aligned associated insulated conductor and become embedded slightly, e. g. about 0.010 cm, in the bottoms of the conductor-receiving facilities of the housing. This supplements side edge support of the terminals 42-42 in the housing 41 to prevent unintended movement of the terminals.

The terminal 42 also includes two sets of side edge barbs. One set of barbs 83-83 are disposed adjacent to the tangs 82-82. Another set of side barbs 85-85 are disposed between the barbs 83-83 and shoulder portions 76-76. The out-to-out distance of the side barbs 85-85 is about 0.27 cm. As the terminals 42-42 are seated in the housing 41, the barbs 83-83 and the barbs 85-85 dig into the end walls 68 and 69 of the housing 41 to anchor the terminals in the slots 64-64. The plastic housing 41 cooperates with the edge surfaces of the terminal 42 to support the terminals in an inserted position.

Each terminal 42 has an externally facing portion in the form of a reference edge surface 90 (see FIGS. 1-2 and 6-7). The reference edge surface 90 extends from the end edge surface 78 toward the other end edge surface 77. Because the reference edge surface 90 is spaced a predetermined distance from the tangs 82-82 which engage the plastic material of the housing 41, it becomes a datum or reference surface for internal and external contact portions of the terminal 42.

In order to engage an external component such as a jack wire, the terminal 42 includes an external contact portion. The external contact portion is exposed to an outer surface of the housing to engage an aligned external component such as a wire-like contact element of a jack into which the plug is inserted to complete an electrical circuit from the cord to the jack.

In a preferred embodiment, the external contact portion is configured to include a fin-shaped protrusion 94 (see FIGS. 1, 2, 6, and 7) which extends from the body portion 74 along the exposed reference edge surface 90 of the terminal. As can be seen, the protrusion 94 is disposed asymmetrically of the body portion 74 and is closer to the end surface 77 than to the end surface 78. When the terminal 42 is positioned in the housing 41, the protrusion 94 is adjacent to the termination end 46 of the housing 41.

The outermost portion of the protrusion is spaced a predetermined distance above the reference surface 90. This insures that it is within a range of distance, i.e. about 0.046 to 0.071 cm, below the outer edge surfaces of the partitions 61-61 when the tangs 82-82 are embedded in the bottoms of the troughs 56-56.

Going now to FIGS. 8-9 and FIGS. 10-12 there are shown views of a filamentary core 25 with three tinsel ribbons 27-27, for example, wrapped thereabout which as mentioned hereinbefore may be the structure of one of the insulated cord conductors 22-22. Each of the tinsel ribbons has a thickness of about 0.063 cm and a width of about 0.05 cm. In FIG. 10 is shown the ideal wrapping of the three ribbons, the ribbons being designated 101, 103 and 105. As can be seen, the ribbon 101 is wrapped about the core 25 so that it is in continuous engagement with the core. On the other hand, the ribbon 103 is wrapped to cause a portion 107 thereof to overlap a trailing portion of the next successive turn of the ribbon 101. Also, as can be seen, the ribbon 105 is wrapped so that a trailing portion 108 of each turn overlaps a leading pertion of an adjacent turn of the ribbon 101 and so that a leading portion 109 thereof overlaps a trailing portion of an adjacent turn of the ribbon 103.

It has been found that the wrapping of the ribbons is carried out so that the arrangement appears more nearly as shown in FIG. 11. There, it is seen that the ribbons 101 and 105 are substantially in engagement with the core 25. The third one of the ribbons i.e., ribbon 103, is stacked on the ribbon 101 to be congruent therewith. Also from FIG. 11, it can be observed that gaps 111 may exist between turns of adjacent ribbons. Further, at diametrically opposed locations along the core 25, a stack of turns of the ribbons 101 and 103 oppose and are aligned with a single turn of the ribbon 105.

Still another wrapping arrangement of the ribbons is possible in the cordage. This is depicted in FIG. 12. In it, both of the ribbons 101 and 105 are in substantial engagement with the core 25. The ribbon 103 is would to overlap a trailing end portion of each turn of the ribbon 105 and a leading portion of the ribbon 101.

Viewing now FIGS. 13, 14 and 15, there are shown front elevational views of a prior art blade-like terminal 120, of a presently used terminal 122 and of a terminal 42 of this invention, respectively. One of the differences among the terminals is that portions of the terminal which form the side edge barbs in FIG. 15 are configured differently from those in FIGS. 13 and 14. A broken line 124 in each of FIGS. 13-15 represents an outer topmost portion of the tinsel ribbon arangement of an insulated tinsel conductor 22 positioned in a trough 56 of a plug housing 41, as viewed in FIGS. 13-15.

More importantly, the arrangement and configuration of the tangs which penetrate the tinsel conductors is different among the terminals. As can be seen in FIG. 13, tangs 125-125 of the terminal 120 have a width, w_1, as measured in the plane of the drawings along the line 124 of a tinsel conductor terminated by the terminal 120. The width, w_1, is the maximum width of the tang 125 as seen by a tinsel ribbon of the conductor 22 penetrated thereby. In FIG. 14, because of the shape of tangs 126-126 of the terminal 122, the maximum width of penetration of the tinsel ribbons by a tang 126, w_2, is measured in a direction parallel to the line 124 but slightly therebelow. For the terminal 42 shown in FIG. 15, the width of penetration or shear of a tang 82 is labelled w_3 and is taken along the line

124 at the outer top of the tinsel wrap.

It should be apparent from a comparison of FIGS. 13-15 and also of FIGS. 8 and 9, that the widths w_1 and w_2 of prior art and presently used terminals is substantially greater than the width w_3 of the terminal of the plug of this invention. As a result, substantially less width of a tinsel ribbon is sheared by the tangs of the terminal in FIG. 15 than those in FIGS. 13 and 14. In fact, so much of the width of a tinsel ribbon or of a stranded conductor terminated by the terminal of FIG. 13 or of FIG. 14 is sheared, that subsequent movement of the cordage such as, for example, by a customer, may cause the tinsel ribbon to be separated into separate portions along the line of shear. In fact, as is seen in FIG. 9, the width w_2 of presently used terminals is greater than the distance across a tinsel ribbon as measured parallel to an axis of the conductor.

This may become particularly acute in the ribbon arrangement of FIG. 11. Should one of the tangs be centered on a stack of turns of the ribbons 101 and 103, the tang also will penetrate the aligned turn of the ribbon 105. With tang widths of the terminals of FIGS. 13 and 14, substantially the entire distance across the ribbon as measured in a direction parallel to the axis of the insualted conductor for all of those aligned turns will be penetrated.

This problem may be seen best by viewing FIGS. 10, 11 and 12 which depict the ribbon wrap arrangements with a terminal superimposed thereon. As can be seen in FIGS. 11 and 12, it becomes possible for the tangs of the terminals to penetrate all three of the ribbons after they have been driven into the plastic beds of the conductor-receiving troughs during the assembly of the terminals with the plug housing. Should this occur, particularly with the terminal widths shown in FIGS. 13 and 14, each of the ribbons may separate into portions and be rendered inoperative.

Of course, the foregoing may not be a problem to continued service of the cordage because of the use of three or more tinsel ribbons in each conductor. It had been thought that at least one of the ribbons would remain intact. This may net always be true because of the relationship which exists among the spacing of the tangs of the prior art terminals and the lay length of each of the helically wound ribbons.

Furthermore, a tang of a terminal may become positioned in a gap 111 (see FIG. 11) between congruent turns of ribbons 101 and 103 and an adjacent ribbon 105. This also may occur with a gap 113 of the arrangement shown in FIG. 12. These gaps may be substantially wider than shown so that edge surfaces of adjacent ribbons may not engage or may not maintain electrical engagement with the terminal. Worse, if the spacing between the tangs corresponds to the lay length of the ribbons such as with the terminal 122 in the ribbon arrangement of FIG. 11, both tangs may be received in such gaps.

This problem has been overcome with the modular plug of this invention. Not only does the terminal 42 of the modular plug 23 have tangs of substantially less width as measured in a direction parallel to longitudinal axes of the conductors than those of prior art and presently used terminals, but also, the spacing between the tangs differs from the lay length of each of the ribbons (see FIGS. 2, 6 and 10-12). In one embodiment, the center-to-center distance between the tangs is about one and one half times as long as that in prior art terminals.

As is seen in FIGS. 10-12, the terminal tangs do not coincide with the gaps between successive turns of the ribbons. Furthermore, insertion of the terminals does not result in the tangs thereof penetrating through substantial portions of the ribbons. As a result, there is a substantially greater probability of sustained electrical contact between the terminal tangs and the ribbons.

It should also be observed particularly from FIGS. 6, 15 and 16 that a portion 130 each tang 82 is coined, preferably, equally from each major side of the terminal 42. Coining of the portions 130-130 facilitates the insertion of the terminals, allowing, for example, the tangs to move between strands of a conductor such as that shown in FIG. 3. Also, because of the coining, somewhat less metal is penetrated than in the use of prior art terminals.

For the most part, the foregoing description has been with respect to a tinsel ribbon conductor. It should be realized that should the insulated conductor be a stranded conductor such as that shown in FIG. 3, the terminals 42-42 of this invention also will result in the penetration of a lower percent of the individual wire-like conductors than occurs with a prior art terminal. As a result, stranded conductors terminated with terminals of this invention have enhanced reliability and sustained integrity over those terminated with terminals of the prior art.

Although the invention has been described in terms of a terminated cordage wherein the cordage includes stranded conductors or three tinsel ribbons, it should be understood that the invention includes terminated cordage which includes less than or more than that number of ribbons. For example, a cord conductor may include four ribbons wrapped helically about a filamentary core such that two stacks of two each are provided. In another, a fifth ribbon which spans the two helically wrapped stacks may be added.

Claims

1. A terminated cordage, which comprises:

a length of cordage which comprises a plurality of insulated conductors each of which includes:

at least one longitudinally extend-

ing electrically conductive member; and

an insulation material which covers each said electrically conductive member; and

a modular plug which terminates an end of said length of cordage, said plug comprising:

a housing which includes a cavity for receiving said plurality of insulated conductors of said cordage;

a plurality of slots which communicate with said cavity and with an externally facing surface of said housing with each of said slots being aligned with an associated one of said insulated conductors; and

a plurality of blade-like electrically conductive terminals each of which includes insulation-piercing tangs along one edge surface thereof and each of which is disposed in one of said slots such that said tangs penetrate the electrically conductive member of the aligned associated conductor to establish electrical engagement therewith, said terminated cordage being characterized in that

said tangs of each terminal each having a width as measured in a direction parallel to the longitudinal axis of the aligned associated conductor in portions of the tangs which are in engagement with the electrically conductive member of the aligned associated conductor which minimizes the amount of said at least one electrically conductive member of the aligned associated conductor which is penetrated by the terminal when the terminal is inserted and seated in said housing.

2. The terminated cordage of claim 1, wherein each tang of each terminal in a plane generally parallel to a longitudinal axis of a conductor is triangularly shaped with a base attached to a body of the terminal and an apex being embedded in the housing and wherein the thickness of each tang of each terminal decreases in a direction from said body of said each terminal to said apex of said each tang of said each terminal.

3. The terminated cordage of claim 1, wherein each conductor includes a longitudinally extending core member; at least one extending electrically conductive ribbon which is wound helically with a lay length about said core member; and an insulation material which covers said at least one ribbon; and wherein said plug includes a plurality of blade-like electrically conductive terminals each of which includes insulation-piercing tangs along one edge surface thereof and each of which is disposed in one of said slots such that said tangs penetrate the at least one ribbon of an aligned associated conductor to establish electrical engagement therewith, said tangs of each terminal each having a width as measured in a direction parallel to the longitudinal axis of the aligned associated conductor in portions of the tangs which are in engagement with the at least one ribbon of the aligned associated conductor which minimizes the amount of said at least one ribbon which is penetrated by the terminal when the terminal is inserted and said tangs being spaced apart a distance which is other than a multiple of the lay length of said at least one ribbon.

4. The terminated cordage of claim 1 wherein said tangs of each terminal are spaced apart a distance which differs from an even multiple of said lay length.

5. The terminated cordage of claim 4, wherein said cordage includes three ribbons with each turn of each ribbon engaging the core and having a longitudinal edge portion which is in engagement with a longitudinal edge portion of each of two adjacent ribbons.

6. The terminated cordage of claim 4, wherein said cordage includes three ribbons with turns of one of the ribbons substantially being superimposed on another one of the ribbons and with turns of the third ribbon being interposed between adjacent turns of the superimposed ribbons.

7. The terminated cordage of claim 4, wherein successive turns of two of the ribbons alternate with successive turns of each other and wherein each successive turn of the third ribbon is out of engagement with the core and overlies a portion of adjacent turns of the two ribbons.

8. A modular plug, which is adapted to terminate an end of a length of cordage comprising insulated conductors each of which includes an electrically conductive member, said plug comprising a housing which includes a cavity for receiving said conductors of said cordage, a plurality of slots which communicate with said cavity and with an externally facing surface of said housing with each of said slots adapted to become aligned and associated with one of the insulated conductors, and a plurality of blade-like electrically conductive terminals each of which includes insulation-piercing tangs along one edge surface thereof and each of which is disposed in one of said slots such that said tangs are adapted to extend into electrical engagement with an aligned associated conductor, said modular plug being characterized by

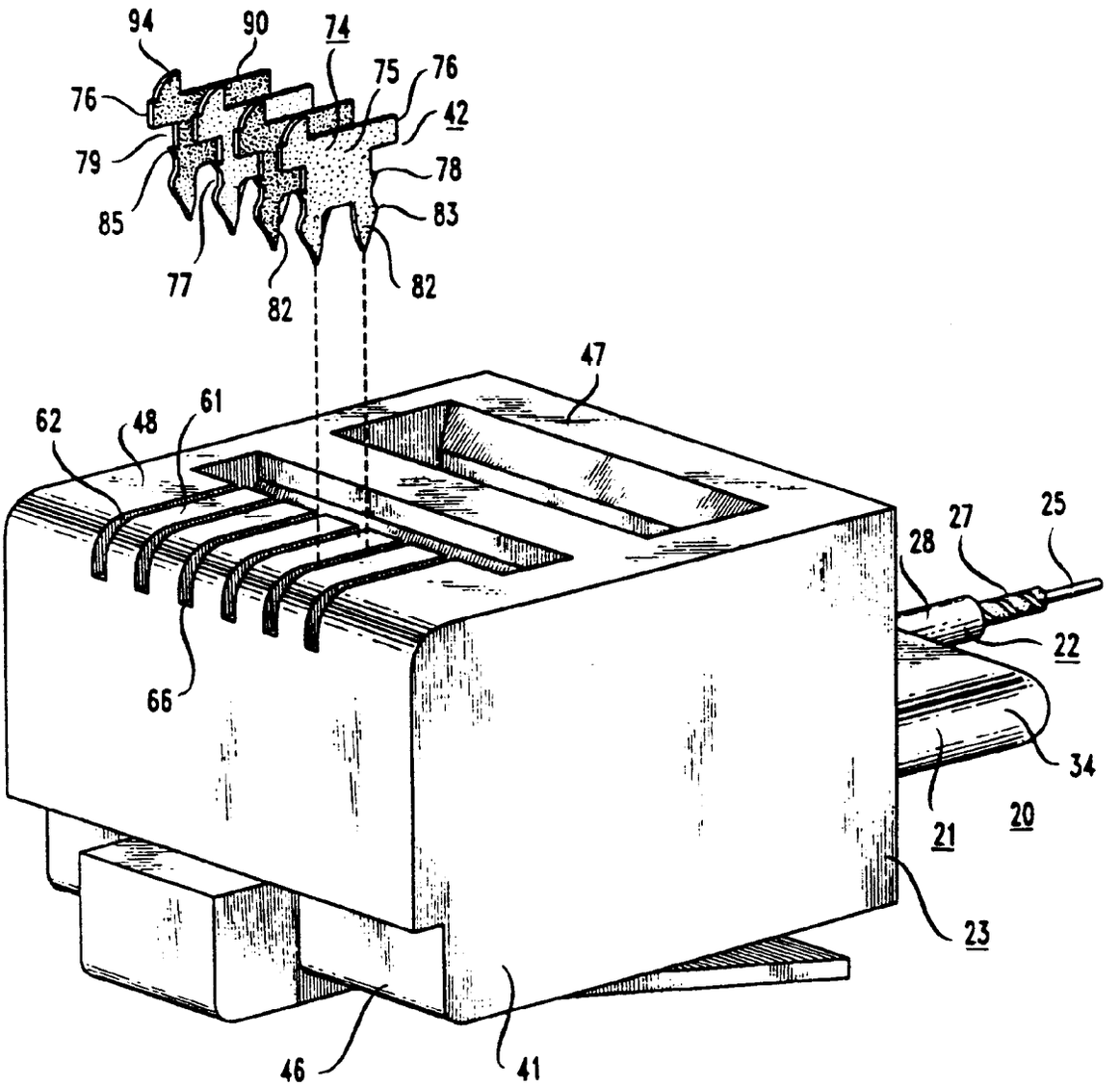
each of said tangs having a width in portions of the tangs which engage the electrically conductive member of the aligned associated conductor as measured in a direction parallel to

a longitudinal centerline of the aligned associated conductor which minimizes the amount of the electrically conductive member which is penetrated by said terminal as said terminal is inserted into said housing.

9. The modular plug of claim 8, wherein the cordage terminated thereby includes a plurality of insulated conductors each of which includes a core and a plurality of electrically conductive ribbons which are wrapped helically about the core with each ribbon having a lay length, and wherein said tangs being spaced apart a distance which is other than a multiple of the lay length of any of the ribbons.

10. The terminal of claim 9, wherein each tang of said terminal in a plane generally parallel to a longitudinal axis of a conductor is triangularly shaped with a base attached to a body of the terminal and an apex being embedded in the housing and wherein the thickness of each tang of said terminal decreases in a direction from said body of said terminal to said apex of said each tang of said terminal.

FIG. 1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41

FIG. 2

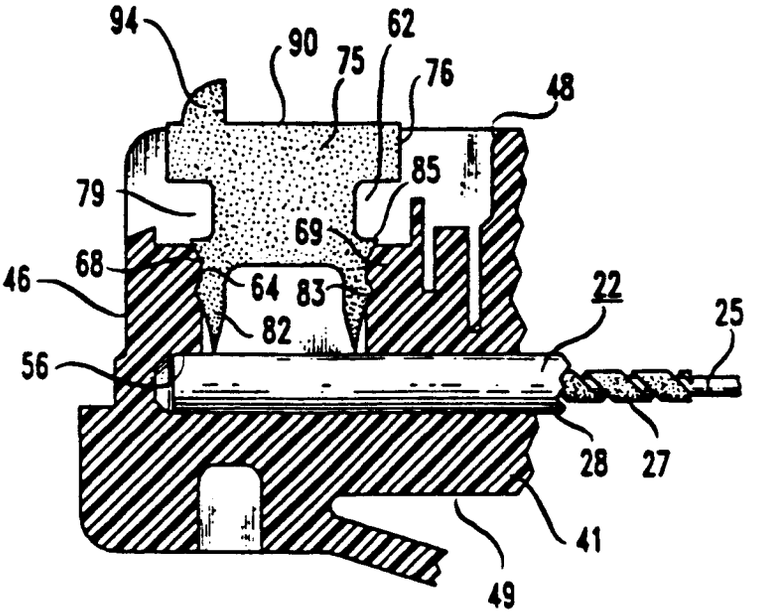

FIG. 4

(PRIOR ART)

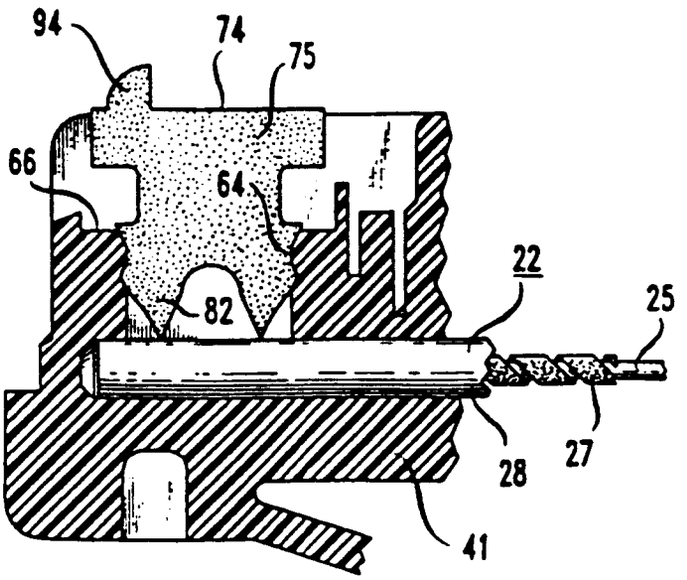

FIG. 3

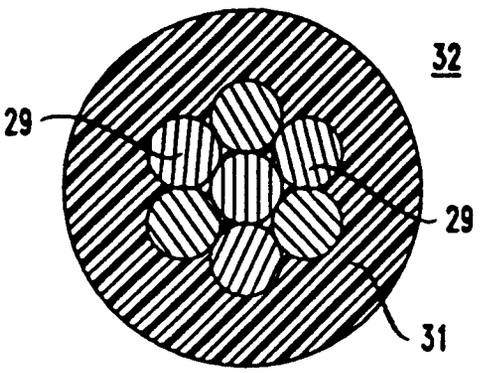

FIG. 5

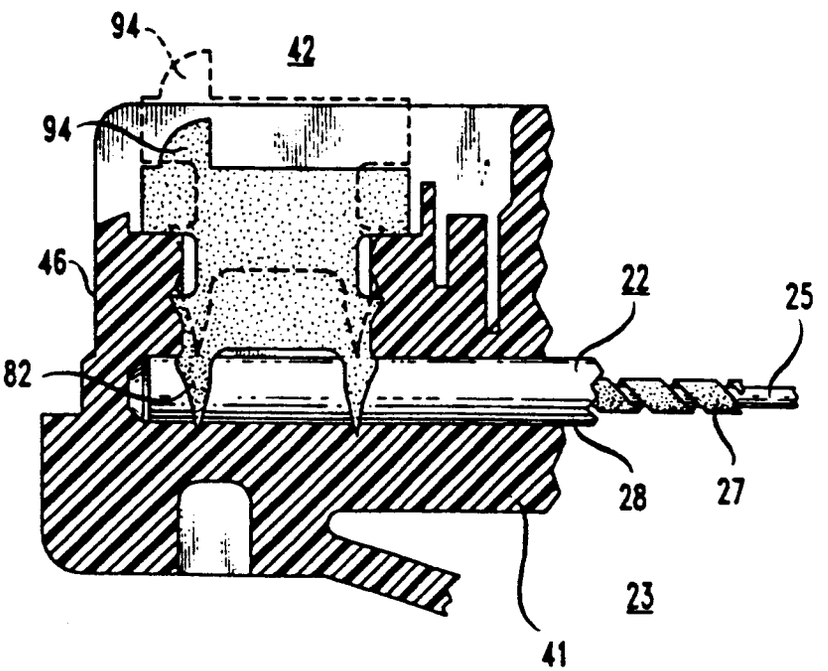

FIG. 6

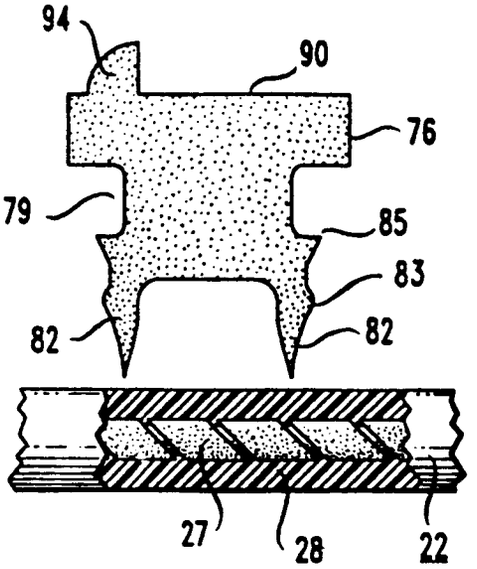

FIG. 7
(PRIOR ART)

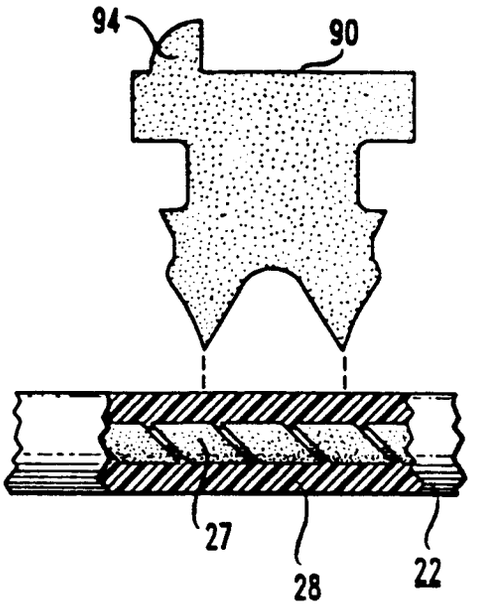

FIG. 8

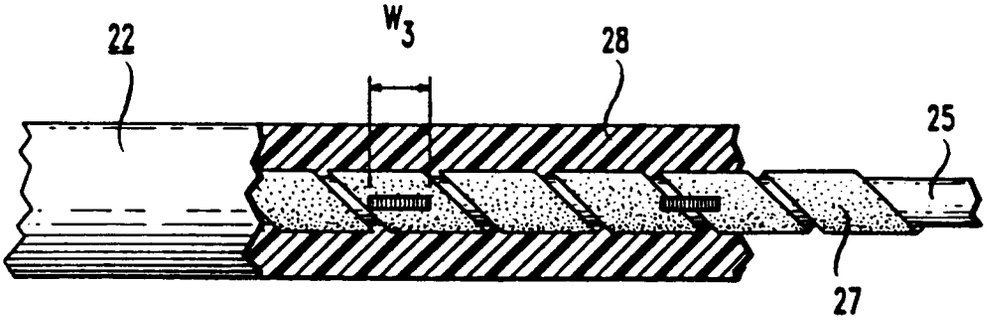

FIG. 9
(PRIOR ART)

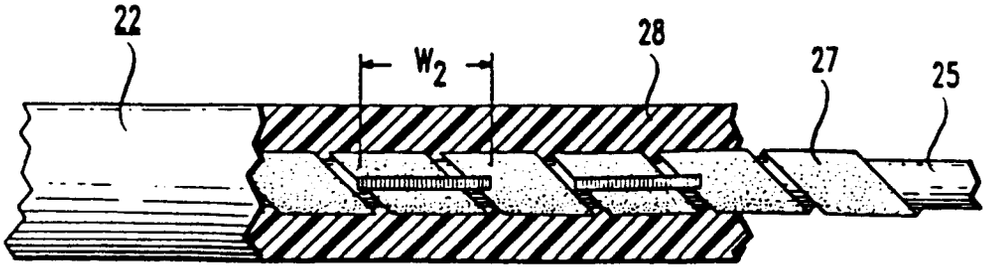

FIG. 10

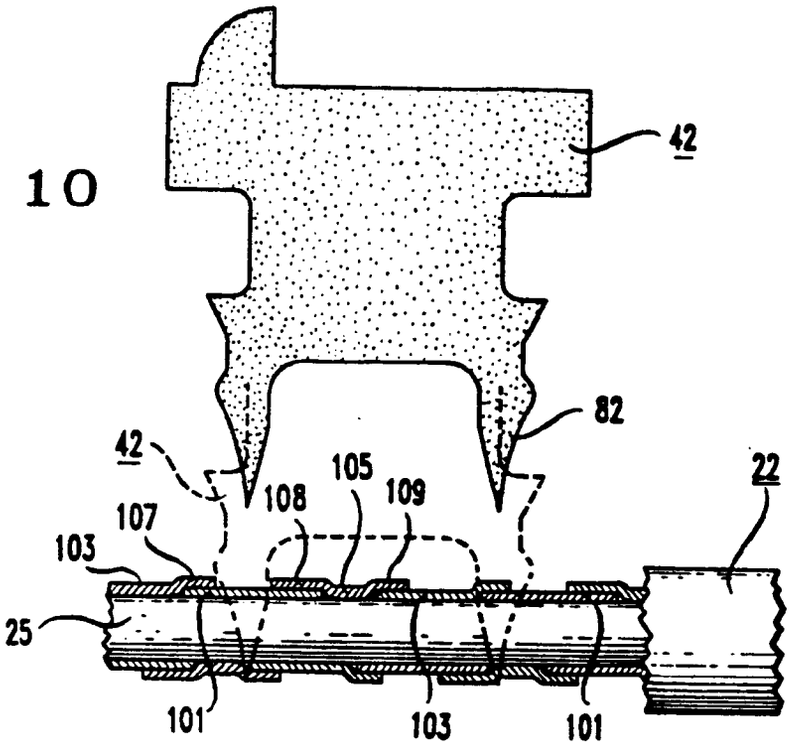

FIG. 11

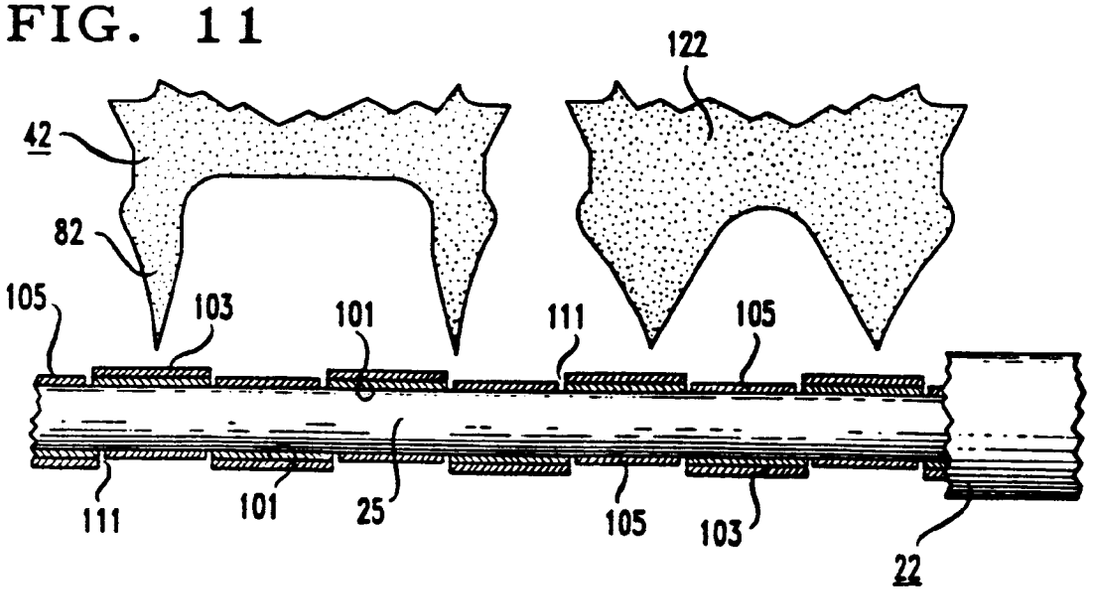

FIG. 12

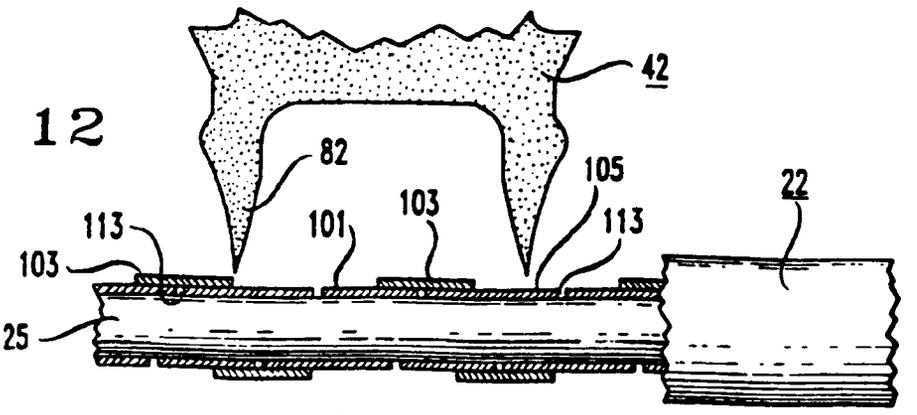

FIG. 13
(PRIOR ART)

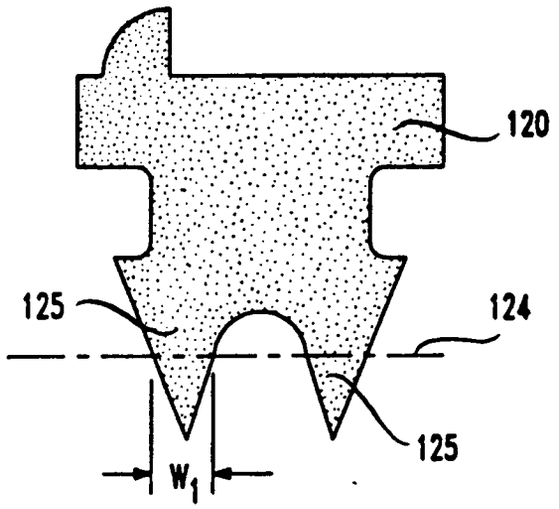

FIG. 14
(PRIOR ART)

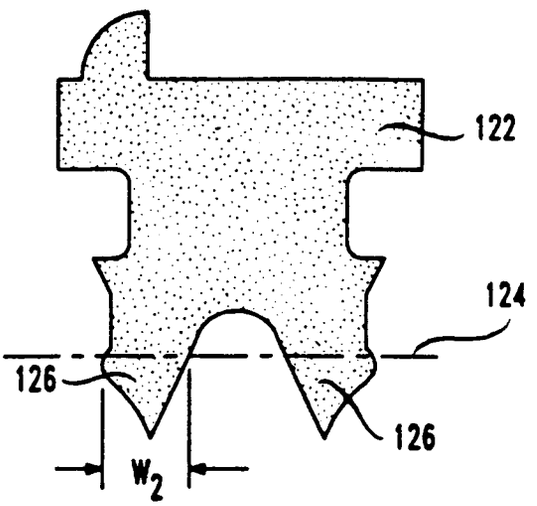

FIG. 15

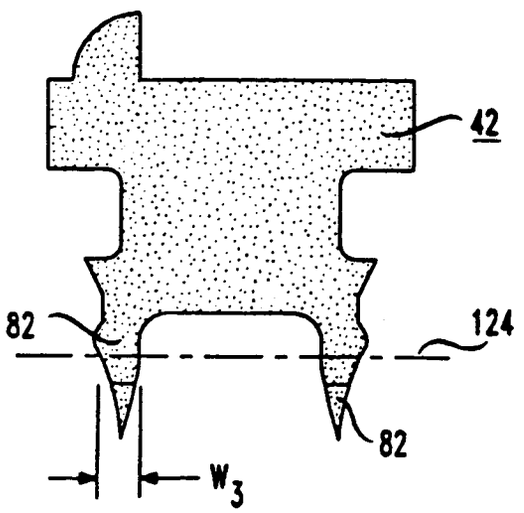

FIG. 16