

- [54] **BIVALVE HOUSING FOR ELECTRICAL TERMINAL**
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- [52] U.S. Cl. **206/330; 156/580; 206/332; 206/343; 206/390; 206/820**
- [51] Int. Cl. **B65d 73/02**
- [58] Field of Search 72/416, 423, 426; 156/580; 29/203 D, 203 DS; 206/330, 332, 328, 329, 343, 347, 820, 390

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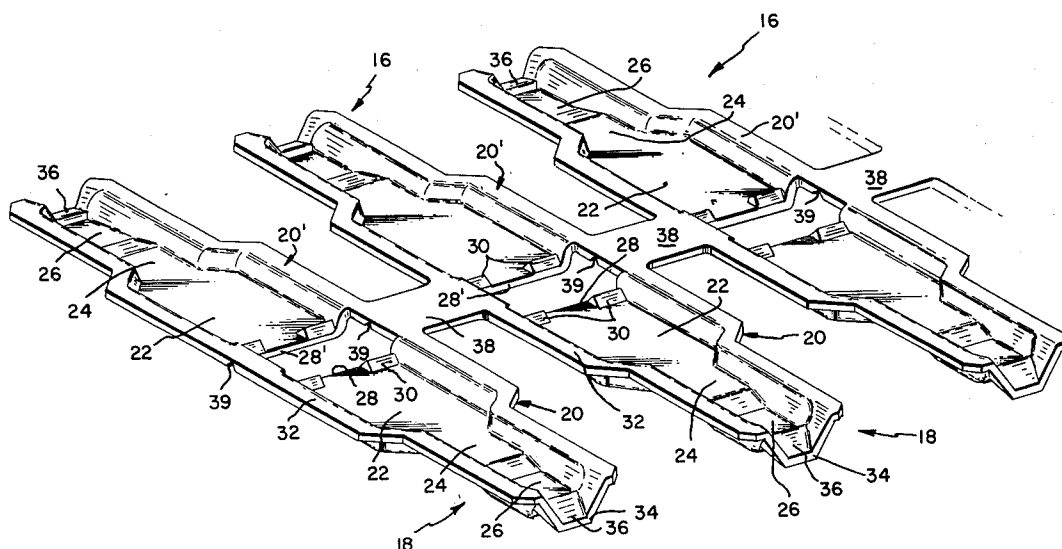
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ABSTRACT

Housings for electrical connecting devices, such as terminals on the ends of wires, are provided in the form of a continuous strip of unassembled housings in side-by-side relationship. The leading housing of the strip is applied to a connecting device by means of an apparatus which assembles the housing to the connecting device and ultrasonically welds meeting edges of the housing to each other.

3 Claims, 18 Drawing Figures



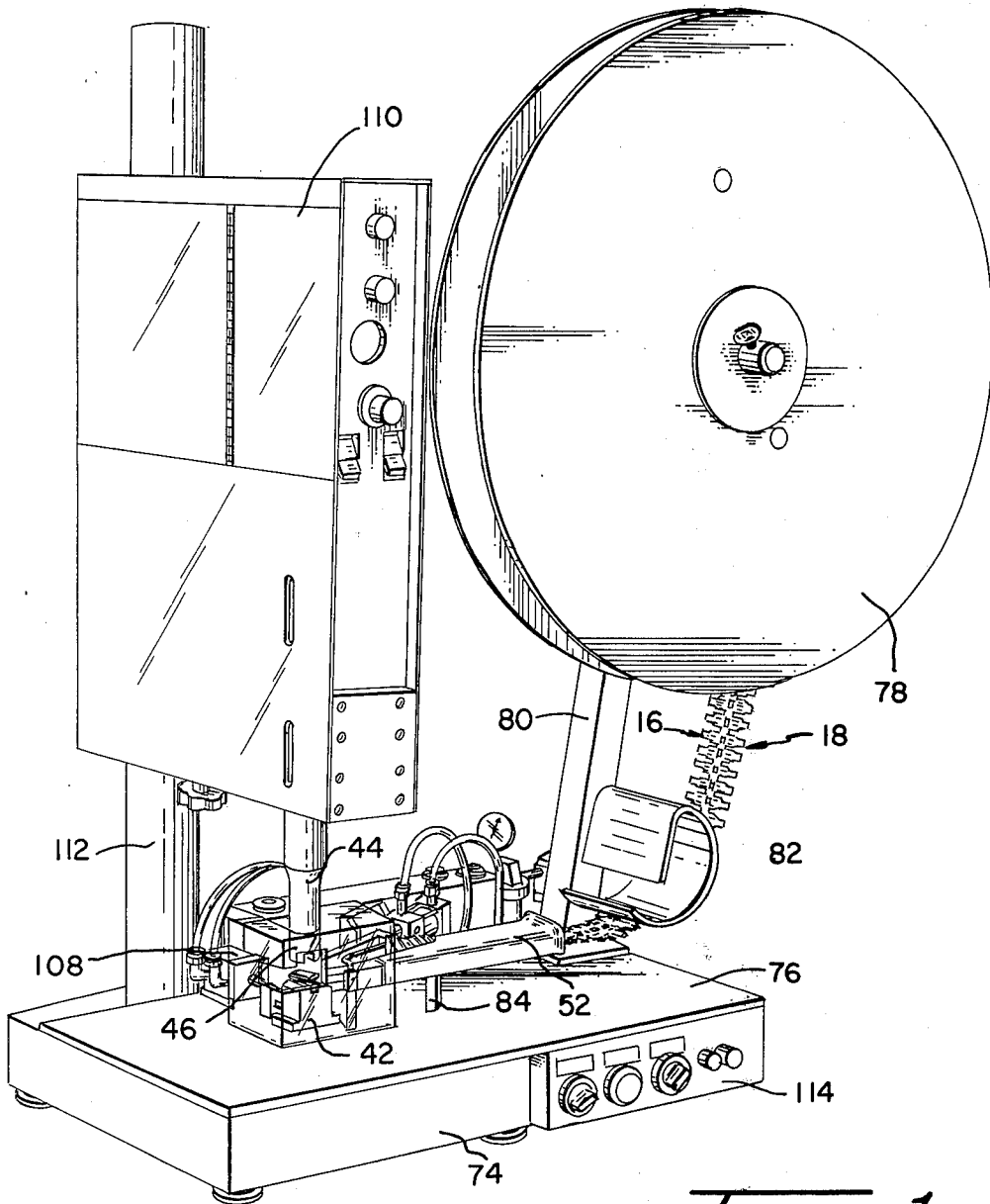
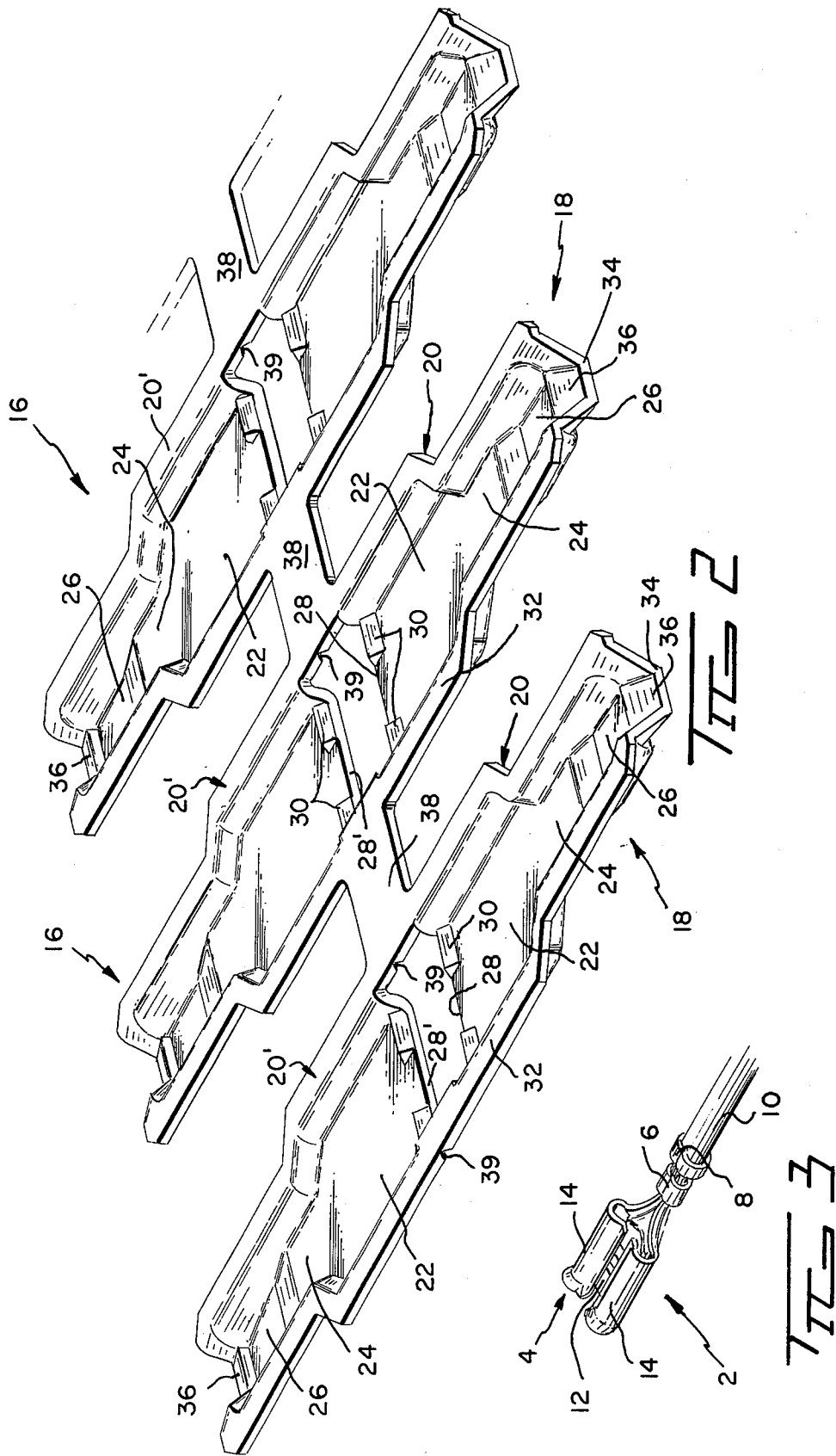
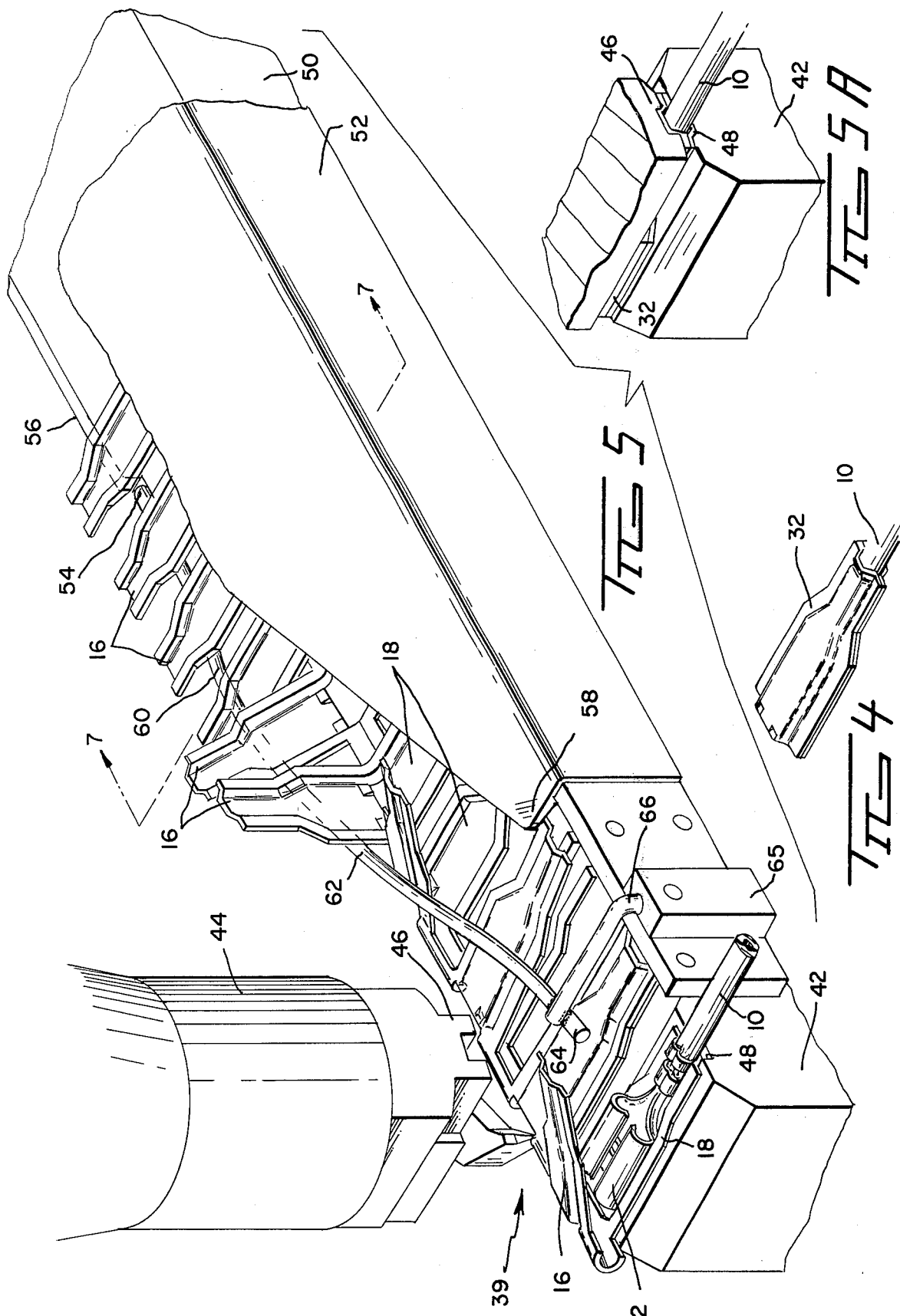
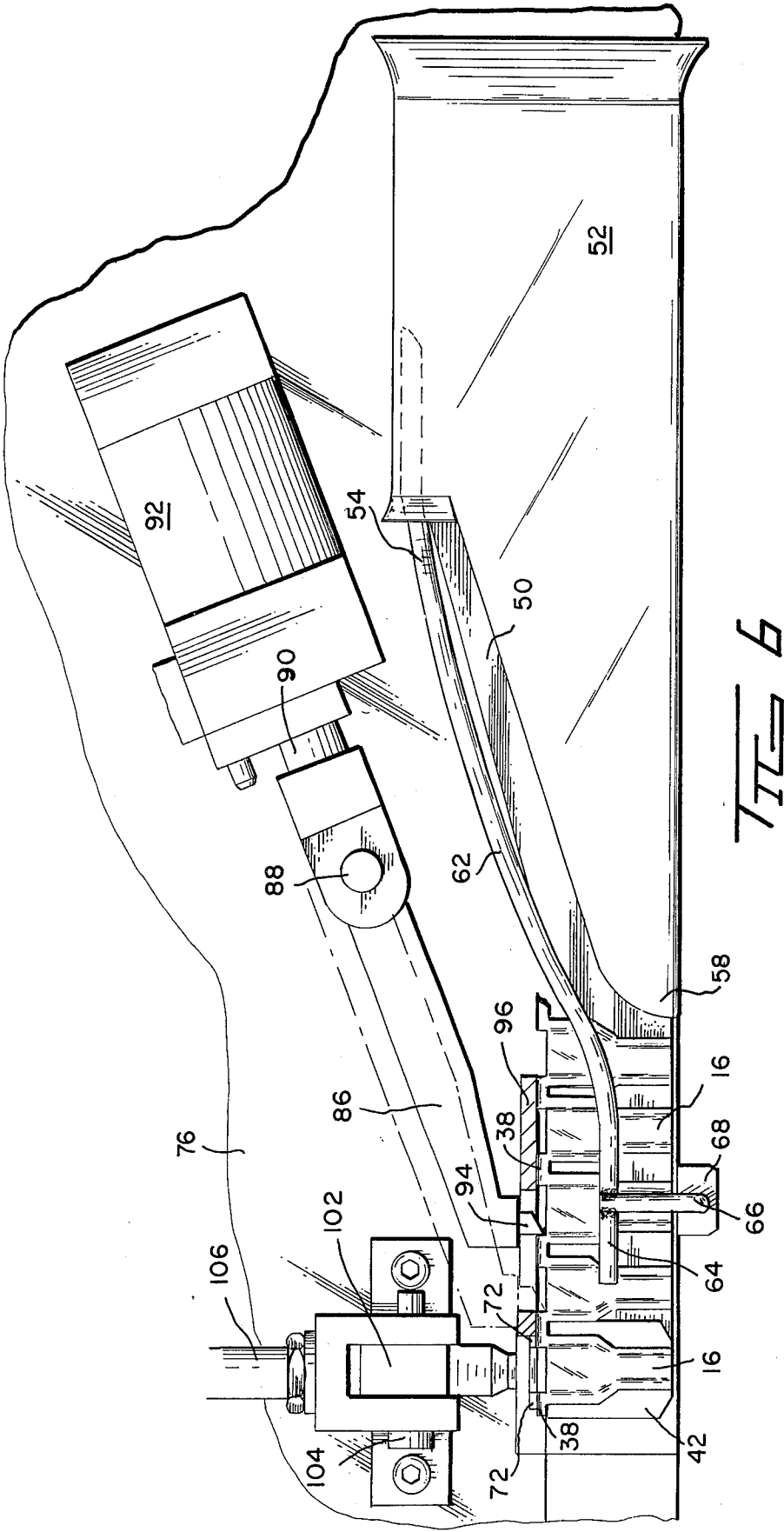
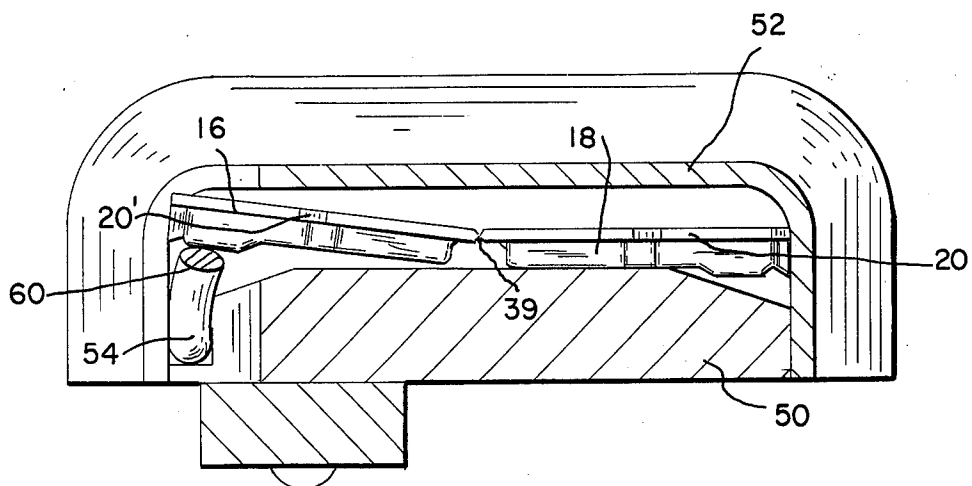


FIG 1

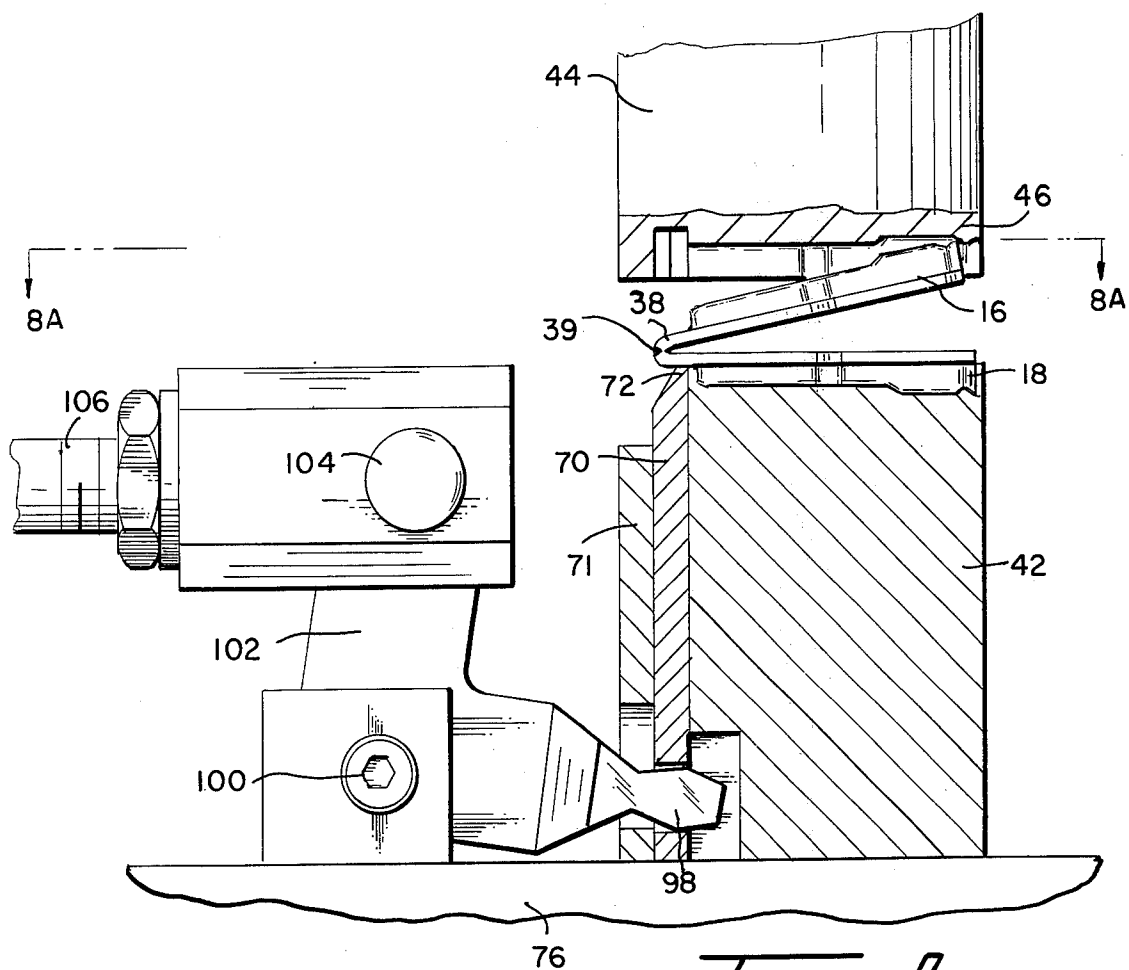




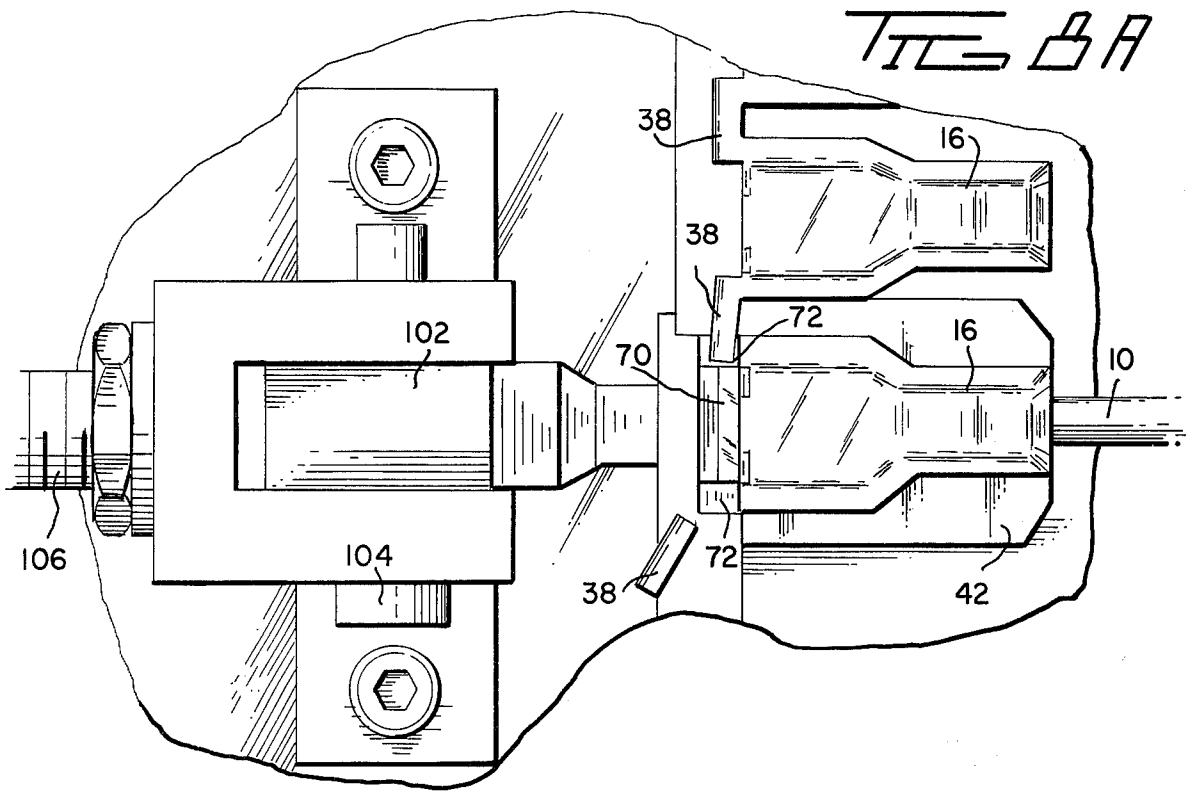
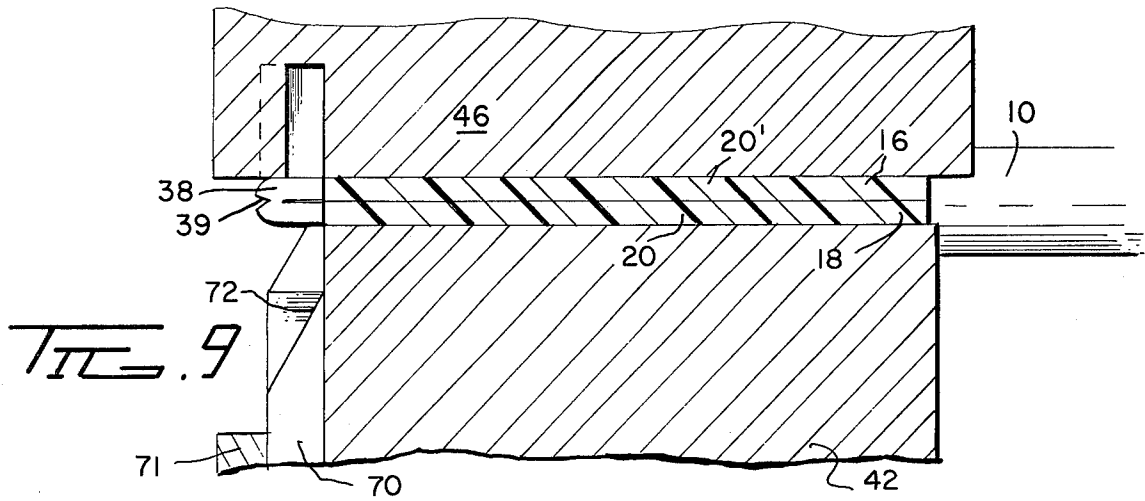
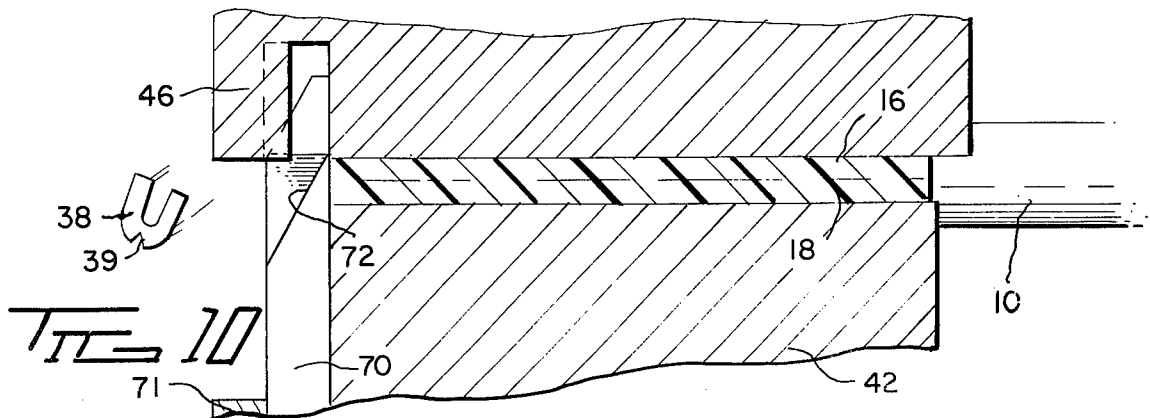


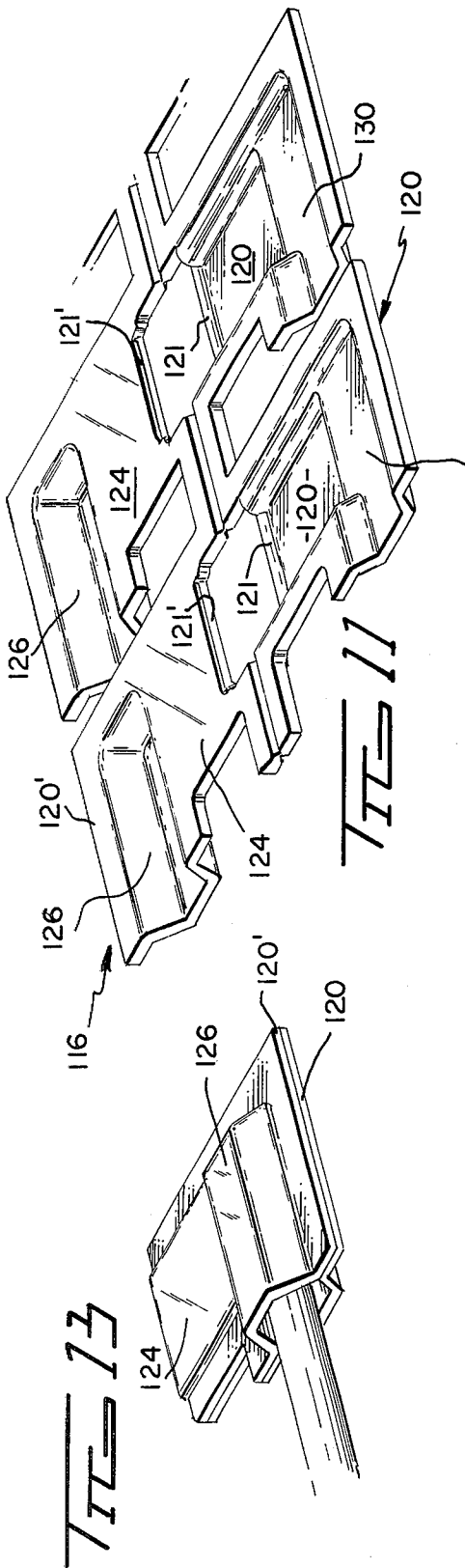
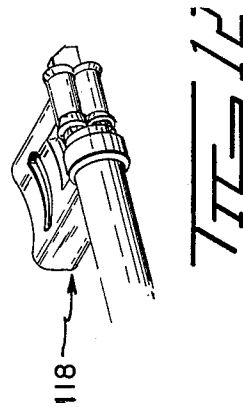
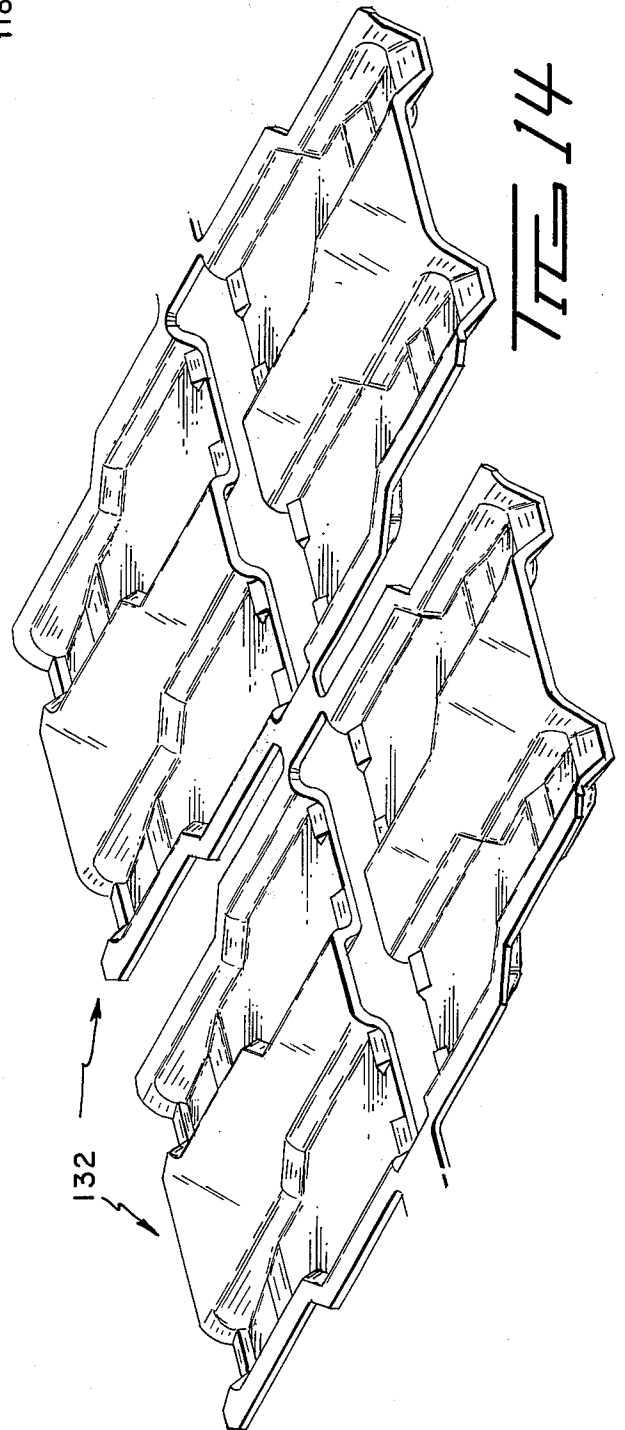


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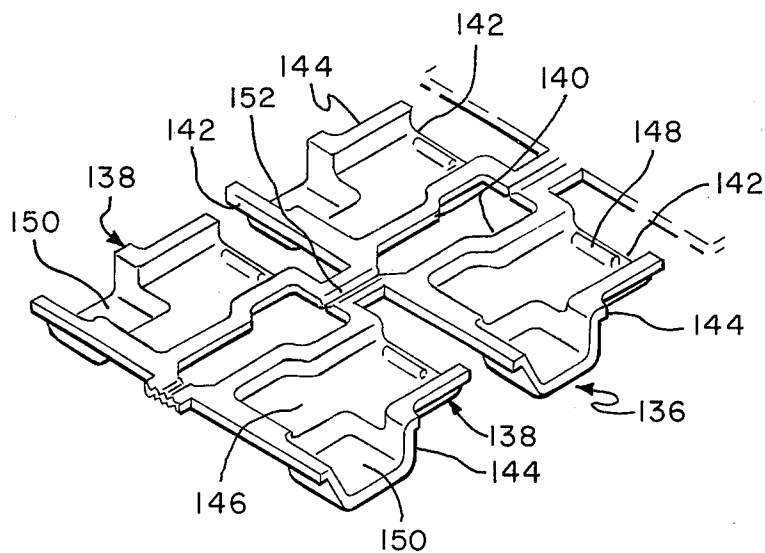


FIG. 15

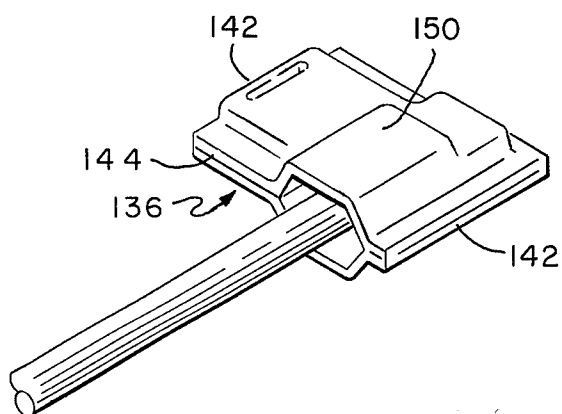


FIG. 16

BIVALVE HOUSING FOR ELECTRICAL TERMINAL

BACKGROUND OF THE INVENTION

This application is a Continuation-In-Part of application Ser. No. 255,666 filed May 22, 1972, now abandoned.

This invention relates to housings for electrical connecting devices. One herein disclosed embodiment of the invention is specifically directed to and specifically shows, a housing for an individual terminal on the end of a wire and an apparatus for assembling individual housings of this type to individual terminals. However, it will be apparent to those skilled in the art that the principals of the invention can be applied to other forms of housings and connecting devices, for example, to the provision of a single housing on a plurality of terminals to form a multi-contact electrical connector.

It is frequently desirable to assemble an insulating housing of suitable plastic to an electrical device, such as a terminal or a pilot light, which has been in turn secured to an end of a wire or wires. Molded plastic housings have in the past been used as disclosed in U.S. Pat. Nos. 3,329,002 and 3,416,212 and these are highly satisfactory although they are relatively expensive for many applications. It has also been proposed that a strip of suitable plastic be folded over the connecting devices and the edges of the strip welded by a suitable plastic welding apparatus as disclosed in U.S. Pat. No. 3,436,006. It is, however, desirable to perform the plastic so that the finished housing may conform to the electrical device, even if it is of intricate shape.

In accordance with the principals of the instant invention, unassembled plastic housings are provided in the form of a continuous strip of housings in spaced apart side-by-side relationship. The adjacent housings in the strip are connected to each other by a central connecting strip which functions as a hinge so that the leading housing of the strip can be assembled, bivalve fashion, to a connecting device or other electrical device positioned therebetween. After the connecting strip has served its purpose as a hinge, it is removed from the assembled connecting housing and discarded.

It is accordingly an object of the invention to provide an improved plastic housing for an electrical device such as a terminal on the end of a wire or a pilot bulb. It is a further object to provide unassembled housings in the form of an improved continuous strip. It is a further object to achieve a type of housing strip which can be provided in a wide variety of specific configurations for different types of electrical devices and for varying numbers thereof.

These and other objects of the invention are achieved in a preferred embodiment thereof which is briefly described in the foregoing abstract, which is described in detail below and which is shown in the accompanying drawing in which:

FIG. 1 is a perspective view of a preferred form of apparatus for applying electrical housings in the form of a continuous strip to terminals which have been crimped on to the end of wires;

FIG. 2 is a perspective view, on an enlarged scale, of one form of housing strip in accordance with the invention;

FIG. 3 is a perspective view of an electrical terminal crimped onto one end of a wire for which the housings of FIG. 2 are intended;

FIG. 4 is a perspective view of an individual terminal having an individual housing assembled thereto;

FIG. 5 is a perspective view of the assembly zone of the apparatus of FIG. 1 in which the leading housing of the strip is assembled to an electrical terminal, this view showing the positions of the parts at the beginning of an operating cycle;

FIG. 5A is a fragmentary perspective view illustrating the welding or bonding of the edges of a housing at the time of application or assembly to a terminal;

FIG. 6 is a fragmentary plan view of the assembly zone illustrating details of the strip feed mechanism;

FIG. 7 is a view taken along lines 7—7 of FIG. 5;

FIG. 8 is a sectional side view of the assembly zone of the apparatus of FIG. 1 illustrating the actuating means for the knives or cutters which remove the integral hinges from the strip after assembly of the leading housing to a terminal;

FIG. 8A is a view taken in the direction of the arrow 8—8 of FIG. 8;

FIGS. 9 and 10 are fragmentary views on an enlarged scale showing the meeting faces of the welding die and anvil and illustrating the action of the cutters;

FIG. 11 is a perspective view of an alternative form of housing strip in accordance with the invention; the individual housings of this strip being adapted to be assembled to flag type terminals of the type shown in FIG. 12;

FIG. 12 is a perspective view of a flag-type electrical terminal;

FIG. 13 is a perspective view of a terminal of the type shown in FIG. 12 having a housing assembled thereto; and

FIG. 14 is a perspective view of a housing which is adapted to receive two contact terminals.

FIG. 15 is a perspective view of a further embodiment of the invention, the housings of this embodiment being adapted to be applied to flag-type terminals of the general type shown in FIG. 12.

FIG. 16 is a perspective view of a terminal having a housing of the type shown in FIG. 15 applied thereto.

FIG. 2 shows a continuous strip 16 of unassembled electrical terminal housings which are adapted to be applied to electrical terminals of the type shown at 2 in FIG. 3. The terminal 2 has a relatively wide contact portion 4, an integral wire crimp 6, by means of which it is secured to the conducting core of the wire, and an insulating crimp 8 by means of which it is secured to the insulating covering of the wire 10. The contact portion 4 has a relatively wide web section 12 the sides of which are curled inwardly and downwardly toward the web as shown at 14. Contact terminals of this type are adapted to receive a simple blade terminal having a rectangular cross-section and are widely used, for example, in the appliance industry. It is sometimes necessary to provide an insulating housing in surrounding relationship to the terminal in order to prevent the possibility of short circuiting or electrical shock.

The strip 16 is made up of a plurality of unassembled housings 18 in side-by-side spaced apart relationship. Each housing comprises two substantially identical sections 20, 20' which are oriented relative to each other in the manner of an object and a mirror image of the object. Each section has a central relatively wide cavity 22 which is dimensioned to receive the contact portion 4 of a terminal 2 and a relatively more narrow neck portion 24 that merges with the cavity 22 and is of a

width adapted to receive wire 10. The floor of the neck portion 24 is stepped as shown at 26 for the accommodation of the insulation crimp 8 and the floor at the outer end of each section is inclined as shown at 36 to provide a bearing surface for the wire should the wire be flexed relative to the terminal. The proximate ends 28, 28' of the housing sections 20, 20' are spaced apart in the unassembled housing and define, in the assembled housing, an opening for the reception of a complementary blade terminal. Bosses 30, 30' are provided adjacent to these proximate ends to retain the terminal in the housing. The sides of each housing section have flanges as shown at 32 so that when the housings are assembled to terminals, the surfaces of these flanges will be against each other and provide bonding surfaces as explained below.

Adjacent unassembled housings in the strip are connected to each other by connecting strip portions 38 which function as hinges to permit closing of the sections of the leading housing onto an electrical connecting device. In order to facilitate the functioning of these connecting sections 38 as hinges, they are each provided with a V notch 39 on the underside thereof.

Unassembled housings in strip form as shown in FIG. 2 can be manufactured by an injection molding process or, advantageously, by cold forming a continuous flat strip of suitable plastic. In accordance with the cold forming manufacturing method, the strip of plastic is simply fed through a conventional stamping and forming die having the appropriate tooling for blanking the strip and for forming the depressions in the two housing sections 20, 20'. Some flow takes place during such forming so that the bosses 28, 28' can be formed in the finished part. It is desirable, during such forming operations to heat the forming tools while the depressions 22 are being formed in the blanks. The application of heat to the forming tools has the effect of destroying the "memory" of the strip during the manufacturing process so that if the formed housing is heated, it will not tend to return to its original flat shape.

Housings in strip form in accordance with the invention can be manufactured from any suitable plastic material. A suitable nylon, for example DuPont type 101 having a thickness of 0.030 inches has proved to be entirely satisfactory for housings of the type under direct consideration. Alternatively, a polyvinyl chloride strip can be used.

FIG. 5 shows the assembly zone 39 of one form of apparatus (FIG. 1) for assembling housings of the type shown in FIG. 2 to terminals. The assembly operation takes place while the leading housings of the strip is supported on an anvil 42 and while the housing section 20' of this leading housing extends generally obliquely with respect to the housing section 20. The welding tool 44 in the upper surface of the anvil 42 have their opposed surfaces 46, 48 contoured such that when the welding tool 44 is moved downwardly, the flanges 32 of the housing sections will be against each other as shown in FIGS. 9 and 10. While the flanges are so held, the tooling is ultrasonically vibrated at a frequency of 20,000 cycles per second. As a result, the flanges will be welded to each other in a secure tight bond.

The strip 16 of unassembled housings is fed toward the assembly zone 39 over a feed block 50 by means of a feeding mechanism shown in FIG. 6 and described below. A sheet metal shield 52 is secured to the front surface of the block 50 and has a flange extending lat-

erally over the strip of unassembled housings. On the rearward side of this feed block there is provided a guide and camming rod 54 which extends transversely across the strip and towards the assembly zone as shown at 62. The shield 52 stops short of the assembly zone as shown at 58 and is cut away immediately adjacent to its left hand end in order to permit progressive folding of the sections 20' of the unassembled housing relative to the sections 20 in the manner of the two parts of a bivalve.

The camming rod has its end 64 located immediately adjacent to the anvil 42 and is shaped such that the housing which is next adjacent to the leading housing of the strip will be completely closed by the time it reaches the end 64 of the rod. The rod 64 is supported by means of a support rod 66 which extends forwardly and is secured to a mounting block 68 secured in turn to the feed block 50.

Folding of the housing sections as shown in FIG. 5 has the effect of straining or stretching the material of the hinges between adjacent housings so that after the strip is fed from the position of FIG. 5, the housing which is located below the tooling 44 will partially open although the section 20 will not snap open entirely. It should also be mentioned that the open position of the welding die 44 is such that when the leading housing of the strip snaps open it will bear against the under side of the die as shown in FIG. 8.

At the beginning of the operating cycle, the parts will be in the position of FIG. 5 and the operator merely locates a terminal 2 on the end of a wire in the depression of the housing section 20 as shown in FIG. 5. Thereafter, the welding die 44 is moved downwardly until the housing flanges are pinched between the die and anvil and the opposed flanged surfaces are welded as previously described. It then becomes desirable to remove the connecting strip or hinge means from the leading housing which has now been assembled to a terminal. The removal of the hinge means is accomplished by means of a cutting blade 70 (FIGS. 8, 8A, 9 and 10) disposed against the rearward side of the anvil 42. This cutting blade has two cutting edges 72 which are effective to sever the hinge upon upward movement of the blade as shown in FIG. 10. The left hand cutting edge as viewed in FIG. 5 severs the connecting section which is integral with the left hand side of the leading housing completely from the housing so that this connecting section portion falls away as scrap as shown in FIG. 10. The cutting edge which severs the next adjacent connecting section (the connecting section which connects the leading housing of the strip to the next adjacent housing) merely severs that next adjacent connecting section from the leading housing. In this manner, after feeding of an unassembled housing to a location between the crimping or assembling die and anvil, the leading housing will have a hinge at each side thereof.

The type of assembly tooling shown in FIG. 5 can be provided with a variety of different types of ultrasonic generating units and feed systems. FIG. 1 for example shows a complete assembling machine comprising a base 74 and a mounting plate 76 on the base on which the assembly apparatus is mounted. The unassembled strip housings are supplied from a reel 78 which in turn is rotatably mounted on a bracket 80 extending from the base. The strip is guided over a guide plate 82 and towards the feed block and sheet metal guide shield as described previously. The strip is fed by means of a

feed finger 86 (FIG. 6) which is pivoted at 88 to a clevis on the end of a piston rod 90 extending from a pneumatic piston cylinder 92 which is also mounted on the mounting plate. The end 94 of the feed finger extends through a slot in a plate 96 secured to the rearward side of the guide block which is of reduced width in the assembly zone as clearly shown in FIG. 6. During each operating cycle, the piston rod 90 is advanced to move the feed finger 86 from the full line position of FIG. 6 to the dotted line position thereof. The feed finger pushes against the connecting strip section between two adjacent unassembled housings as also shown in FIG. 6.

Referring again to FIG. 8, the cutting blade 70 is held against the anvil 42 by a suitable retaining plate 71 and is actuated by a bell crank pivoted at 100 between a pair of upstanding ears on the mounting plate 76. One arm of this bell crank is of reduced width as shown at 98 and extends through an opening in the lower end of the blade 70. The other arm 102 of the bell crank extends upwardly as viewed in FIG. 8 and is pivoted at 104 to the end of a piston rod 106 extending from a piston cylinder 108 mounted behind the assembly zone.

An ultrasonic generator 110 is mounted on a vertical post 112 and provides the ultrasonic energy for vibration of the welding tool. This generator may be of any suitable type, for example, a model 430 as supplied by Branson Sonic Power Company of Eagle Road, Danbury, Connecticut. Control means for the ultrasonic generator 110, for the piston cylinder 92 can conveniently be provided at any desired location. In the disclosed embodiment, the electrical controls are provided on the panel 114 and the cycle is controlled by a suitable foot switch, not specifically shown.

To briefly review the operation of the embodiment of FIG. 1, the parts will be in the positions of FIG. 5 at the beginning of the operating cycle. The operator simply positions a terminal on a wire end on the section 20 of the housing located on the anvil 42 and actuates a suitable foot switch or other switch to cause the apparatus to move through its operating cycle. The welding die 44 first moves downwardly and is then ultrasonically vibrated to carry out the welding operation. Thereafter compressed air is provided to the piston cylinder 108 to actuate the cutting knives and trim the connecting sections from the leading housing of the strip. The welding die is then automatically raised and the operator can then remove the completed assembly, FIG. 4, from between the die and anvil. Thereafter, the piston cylinder 92 is energized to feed the strip and position an unassembled housing on the anvil 42.

As previously mentioned, a variety of types of housings can be provided in accordance with the invention. FIG. 11 shows a continuous strip 116 composed of individual housings which are adapted to be assembled to flag-type terminals 118, FIG. 12. The individual housings of the embodiment of FIG. 11 comprises two housing sections 120, 120' disposed on opposite sides of the medial line of the strip. The housing sections in this instance are not identical, the housing section 120 on the left, having a flat surface 124 adjacent to the inner edge 121 and a depression 126 for the accommodation of the wire and crimps. The housing section 120 on the right has a substantially square depression 128 for the accommodation of the curled sidewalls of the contact portion of the terminal. The depression 128 merges with a relatively shallow depression 130 which receives

the end of the insulated portion of the wire and the crimps. The depressions 130, and 126 both open to one side of the two housing sections as shown.

FIG. 14 shows an alternative strip 132 constructed in accordance with the invention in which each bivalve type housing 124 is adapted to receive two contact terminals of the general type shown in FIG. 3. The principles of the invention are, of course, applicable to housings intended for even larger numbers of terminals.

FIG. 14 shows a further embodiment comprising a continuous strip 136 of housing sections which are adapted to be applied to flag-type terminals of the type shown in FIG. 12. Each housing comprises two identical housing sections 138 which are on opposite sides of the center line of the strip. The sections 138 have proximate sides 140, laterally extending sides 142 which are spaced apart in the direction of the length of the strip, and remote sides 144 which extend in the direction of the length of the strip and define the marginal side edges of the strip. A central depression 146 is provided in each section for the contact portion of the terminal and an additional deeper depression 150 is provided for the crimp portion of the terminal, the depressions 150 extending inwardly from the remote sides 144 adjacent to remote corners of the sections. A boss 148 for retaining the terminal is provided adjacent to the laterally extending sides 142 on the lefthand end of each section as viewed in FIG. 15. The corners of the sections which are adjacent to the center line of the strip are connected by hinge means 152 to the corners of the next adjacent housing sections.

The leading housing of the strip 136 is applied to a terminal by locating the contact portion in alignment with the central depressions 146 and the crimp portion in alignment with the depressions 150. The two housing sections are closed onto the terminal, the housings are bonded to each other as previously described, and the hinge means is cut away from the assembled housing. The embodiment of FIGS. 14 and 16 differs from the embodiment of FIG. 11 in that the wire crimped to the terminal extends laterally from the strip at the time of application rather than in the direction of the strip as in FIG. 11.

Though the invention has been described with respect to a specific preferred embodiment thereof, many variations and modifications thereof will immediately become apparent to those skilled in the art. It is therefore the intention that the appended claims be interpreted as broadly as possible in view of the prior art to include all such variations and modifications.

What is claimed is:

1. A continuous plastic strip of unassembled housings, each of said housings being adapted to be assembled to an electrical contact terminal which is crimped onto one end of a wire, said terminal being of the type comprising a relatively wide contact portion and having a crimp portion integral with, and extending centrally from, said contact portion at one end thereof, said strip comprising:

a plurality of individual housings in side-by-side relationship, said housings being spaced apart along the length of said strip, each of said housings comprising a complementary pair of housing sections, said sections being substantially identical and being arranged in opposed relationship with the proximate sides of said housings being spaced apart in the direction of the width of said strip,

each of said sections having a relatively wide portion with a central recess therein for reception of said contact portion of said terminal, said wide portions being proximate to each other and including said proximate ends,

each of said sections including a narrow portion extending laterally of the length of said strip, said narrow portions being adapted to receive said wire, flanges extending from said wide and narrow portions in the plane of said strip, said flanges being against each other and providing bonding surface when said sections are assembled, and

each of said housings being connected to the next adjacent housings by integral hinge means, each hinge means being connected to each of said proximate sides of both of said housing sections of two adjacent housings in said strip and being entirely between said two adjacent housings, said hinge means being foldable along a fold line

extending in the direction of said strip, whereby, the leading housing of said strip can be assembled to one of said terminals by locating said terminal in said depression of one of said sections, closing said sections, bivalve fashion, onto said terminal, bonding said surfaces of said flanges to each other, and severing said hinge means from said leading housing.

2. A continuous plastic strip of unassembled housings, each of said housings being adapted to be assembled to an electrical contact terminal which is crimped onto one end of a wire, said terminal being of the flag type and comprising a relatively wide contact portion and a crimp portion on one side of said contact portion, said terminal being secured to said wire in said crimp portion and extending axially from said one side of said contact portion, said strip comprising:

a plurality of identical housings in side-by-side relationship, said housings being spaced apart along the length of said strip,

each of said housings comprising a complementary pair of housing sections, said sections being generally rectangular and having proximate opposed sides which are spaced apart in the direction of the width of said strip, each of said sections having a recess therein extending in the direction of the length of said strip, said recesses being located adjacent to the sides of said strip and being adapted to receive said wire and said crimp portions of said terminal,

flanges extending from said side portions of said sections in the plane of said strip, said flanges being adapted to be located against each other and providing bonding surface when said sections are assembled to said terminal, and

each of said housings being connected to the next adjacent housings of said strip by integral hinge means, each of said hinge means being connected

to each of said proximate sides of both of said housing sections of two adjacent housings in said strip and being entirely between said two adjacent housings, said hinge means being foldable along a fold line which extends in the direction of said strip whereby,

the leading housing of said strip can be assembled to one of said terminals by locating said terminal against one of said sections with said wire in said depression in said on section, and said sections can be closed, clam-shell fashion, onto said terminal until said surfaces of said flanges are against each other, and upon bonding said surfaces to each other, said housing will be permanently assembled to said terminal.

3. A continuous plastic strip of unassembled housings, each of said housings being adapted to be assembled to an electrical contact terminal which is crimped onto one end of a wire, said terminal being of the flag type and comprising a generally rectangular contact portion and a crimp portion on one side of said contact portion, said terminal being secured to said wire in said crimp portion and extending axially from said one side of said contact portion, said strip comprising:

a plurality of identical housings in sideby side relationship, said housings being spaced-apart along the length of said strip,

each of said housings comprising a pair of identical housing sections, said sections having proximate sides which are spaced apart in the direction of the width of said strip,

said sections having parallel laterally extending sides which are spaced-apart in the direction of the length of said strip and which extend from said proximate sides laterally of the length of said strip, said sections having remote sides which extend generally parallel to said proximate sides and between said laterally extending sides,

said proximate and laterally extending sides of each section defining a corner, each of said corners being connected to the corner of the next adjacent housing section by hinge means, each of said hinge means being entirely between adjacent housings in said strip, whereby said sections can be folded towards each other bivalve fashion, and

a depression in at least one of said housings for reception of said crimp portion of one of said flag-type terminals, said depression

extending to said remote side of said section whereby, upon positioning a flag type terminal between said sections with said crimp portions in alignment with said depression and with the wire crimped to said terminal extending laterally of the length of said strip, and upon closing said sections, securing said sections to each other, and removing said hinge means, said terminal becomes encased in said housing.

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