United States Patent [19]

McIntosh

[11] **3,910,666**

[45] **Oct. 7, 1975**

[54] **ELECTRICAL TERMINAL AND METHOD OF FORMING AN ELECTRICAL CONNECTION THEREWITH**

[75] Inventor: **Harold A. McIntosh,** Los Angeles, Calif.

[73] Assignee: **Robertshaw Controls Company,** Richmond, Va.

[22] Filed: **July 27, 1973**

[21] Appl. No.: **383,204**

[52] **U.S. Cl.** ..... **339/276 T;** 174/94 R; 336/192

[51] **Int. Cl.** **H01r 11/08**

[58] **Field of Search** ..... 339/220, 276; 174/94 R; 336/192

[56] **References Cited**

UNITED STATES PATENTS

1,759,184	5/1930	Bullinger	339/276 C
2,296,346	9/1942	Hearn	339/220 C
2,402,122	6/1946	Bullinger	339/276 C
2,495,103	1/1950	Huppert	339/220 R
2,658,158	11/1953	Bender, Jr. et al.	339/276 R
2,997,680	8/1961	Arthur	339/276 R
3,359,520	12/1967	Foerster	339/276 R

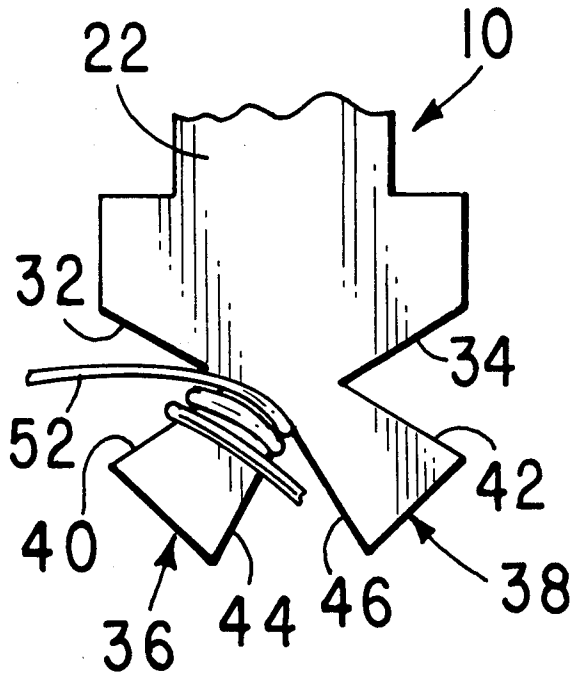
Primary Examiner—Joseph H. McGlynn

Attorney, Agent, or Firm—Anthony A. O'Brien

[57] **ABSTRACT**

An electrical terminal formed of a strip of electrically conductive material having a ductile member extending from an adjoining edge of the electrical terminal such that after a lead wire is wound around the ductile member, the ductile member can be bent against the adjoining edge of the electrical terminal to deform the ductile member to accommodate the lead wire.

8 Claims, 6 Drawing Figures



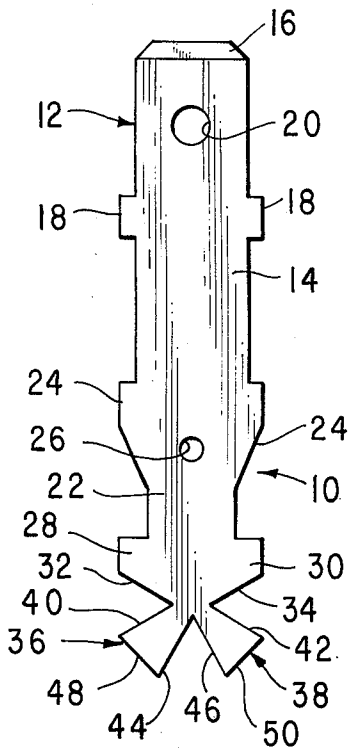


FIG. 1

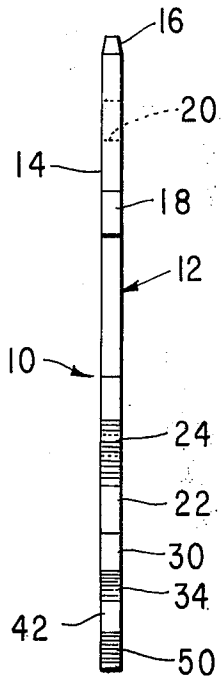


FIG. 2

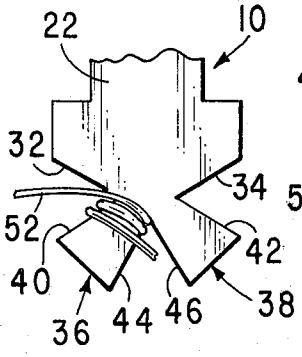


FIG. 3

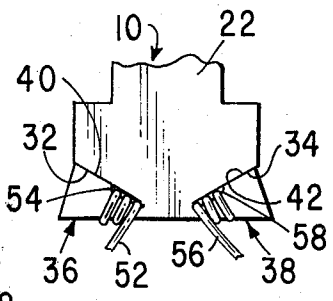


FIG. 4

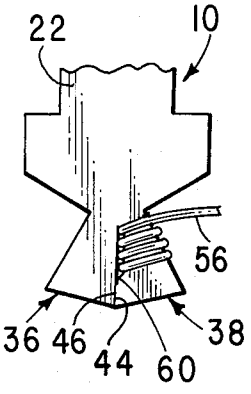


FIG. 5

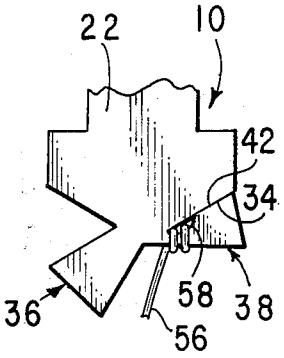


FIG. 6

ELECTRICAL TERMINAL AND METHOD OF FORMING AN ELECTRICAL CONNECTION THEREWITH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to electrical connections and, more particularly, to an electrical terminal and a method of forming a permanent electrical connection between an electrical terminal and a lead wire.

2. Discussion of the Prior Art art

Electrically operated appliances conventionally utilize electrical terminals adapted to be electrically connected with lead wires by soldering, brazing, welding or otherwise mechanically bonding the electrically conductive elements; however, such electrical connections have the disadvantages of requiring special equipment and experienced technicians as well as being difficult to implement for wires of small diameter.

Prior art attempts to obviate the need for soldering and the like in forming electrical connections have utilized screw and wrapped binding posts, as disclosed in U.S. Pat. No. 2,759,166 to Mallina; however, such prior art attempts have not simplified the forming of electrical connections to the extent desired, particularly for small diameter wires.

SUMMARY OF THE INVENTION

The present invention is generally summarized in an electrical terminal including a strip of electrically conductive material having a first edge and a ductile member extending from the first edge, the ductile member having a second edge adapted to have a lead wire wrapped therearound and being bendable to be clamped against the first edge whereby the second edge of the ductile member is deformed to accomodate the lead wire.

The present invention is further generally summarized in a method of forming an electrical connection including the steps of wrapping a lead wire around the edge of a ductile member extending from an electrical terminal, and bending the ductile member against an adjoining edge of the electrical terminal to deform the edge of the ductile member to accommodate the lead wire.

Accordingly, it is a primary object of the present invention to facilitate the forming of electrical connections without requiring soldering or the like.

Another object of the present invention is to construct an electrical terminal with a ductile member extending from an adjoining edge thereof such that a permanent electrical connection can be formed by simply wrapping a lead wire around the ductile member and bending the ductile member to abut the adjoining edge and deform the ductile member to accommodate the lead wire.

A further object of the present invention is to construct an electrical terminal having a pair of ductile ear members extending therefrom and adapted to have lead wires wound therearound, the ear members being bendable to clamp the lead wires either against each other or against edges of shoulders formed on the electrical terminal.

The present invention has an additional object in that a ductile member of an electrical terminal has a wedge-like configuration to prevent a lead wire wound therearound from slipping off the ductile member and to facilitate the winding of the lead wire near a base portion of the ductile member to assure sufficient deformation of the wire and the ductile member when the ductile member is clamped against the electrical terminal.

Yet another object of the present invention is to provide a method of forming an electrical connection requiring only the wrapping of a lead wire around an edge of a ductile member extending from an electrical terminal and bending the ductile member against an adjoining edge of the electrical terminal to deform the ductile member and accommodate the lead wire.

Some of the advantages of the present invention over the prior art are that a permanent electrical connection can be formed without requiring soldering or the like, wires of small diameter and wires that are difficult to solder can easily be permanently connected with the electrical terminal, contamination of components from soldering rosin or acid is eliminated, more than one lead wire can be attached to the electrical terminal, the electrical connection is highly resistant to vibration, the method of forming the electrical connection can be easily automated and the electrical terminal can be stamped and therefore is inexpensive to manufacture.

Other objects and advantages of the present invention will become apparent from a description of the preferred embodiment taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of an electrical terminal according to the present invention.

FIG. 2 is a side view of the electrical terminal of FIG. 1.

FIG. 3 is a broken top plan view of the electrical terminal of FIG. 1 having a lead wire wound around one of the ductile ear members extending therefrom.

FIGS. 4, 5 and 6 are broken top plan views illustrating various electrical connections formed with the electrical terminal of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An electrical terminal **10** according to the present invention, as illustrated in FIGS. **1** and **2**, is formed of a flat strip **12** of electrically conductive, ductile material sufficiently soft to set when deformed. The strip **12** has a shank **14** extending from a tapered end **16** with a pair of rectangular tabs **18** extending from opposite side edges thereof, an aperture **20** being centrally disposed in the shank **14** between the tabs **18** and tapered end **16.** Shank **14** joins a neck **22** at a pair of sloping lugs **24** extending from opposite sides of the shank and aligned with a centrally disposed aperture **26,** and neck **22** terminates at a pair of shoulders **28** and **30** having edges **32** and **34** angularly oriented relative to the longitudinal center of strip **12.** A pair of ductile ear members **36** and **38** extend from edges **32** and **34** of shoulders **28** and **30** and have outer edges **40** and **42** angularly oriented relative to the longitudinal center of the strip joining edges **32** and **34** at an apex, respectively. Ears **36** and **38** have inner edges **44** and **46,** respectively, meeting at an apex aligned with the longitudinal center of strip **12,** the inner edges **44** and **46** having included angles with the longitudinal center of the strip less than the included angles of outer edges **40** and **42,** respectively, such that the ears **36** and **38** each have a wedge-like configuration with ends **48** and **50** wider

than the narrower base portions joining the ears with shoulders **28** and **30.**

In use, a lead wire **52** to be electrically connected to the terminal **10** is wound around one of the ductile ears, for instance, ear **36** as illustrated in FIG. **3.** The wire **52** is wound several times around the ear **36** near the base portion thereof with the number of turns dependent upon the diameter of the wire such that the wire builds up to a height to cause the ear to deform as it is bent against an adjoining edge such as the edges of the other ear or the edges **32** and **34** of shoulders **28** and **30.** That is, as illustrated in FIG. **4,** the ear **36** can be bent such that outer edge **40** thereof abuts edge **32** of shoulder **28** thereby causing the wire **52** to deform the edge **40,** as shown at **54;** and, similarly, ear **38** can have a lead wire **56** wound therearound such that the outer edge **42** is deformed as shown at **58** in FIGS. **4** and **6** when the ear is bent to have outer edge **42** abut edge **34** of shoulder **30.** In FIG. **5,** the ear **38** having wire **56** wound therearound and the ear **36** are bent toward the longitudinal center of the terminal **10** such that the inner edges **44** and **46** of the ears abut to cause the wire to deform the inner edge **46** of ear **38,** as shown at **60.**

As is shown in FIG. **4,** a plurality of lead wires can be connected with electrical terminal **10** by wrapping the lead wires around both ears **36** and **38** and bending the ears against shoulders **28** and **30.** By slanting the edges **32** and **34** of the shoulders toward the longitudinal center of the strip **12** in opposite directions relative to the slanting of the outer edges **40** and **42** of the ears, when the ears **36** and **38** are bent against the shoulders **28** and **30,** respectively, the angular orientation of the inner edges **44** and **46** of the ears relative to the longitudinal center of the strip will cause the inner edges to be disposed in a line transverse to the longitudinal center thereby providing a regular and compact configuration for the electrical connection. The protruding orientation of the shoulders **28** and **30** position the edges **32** and **34** thereof at positions to cooperate with the edges of the ears **36** and **38;** however, the shoulders can be disposed with any desired configuration to accommodate two or more ductile ears.

The bending of the ductile ears around which lead wires are wound against any of the edges of the electrical terminal **10** clamps the lead wires to deform the ductile ears at the edges thereof to permanently fix the lead wires to the electrical terminal. The wedge-like configuration of the ears **36** and **38** with the ends wider than the base portions prevents the lead wires from slipping off of the ears either before or after the ears are clamped against an opposing edge and, further, serves to facilitate positioning of the wire at the base portions of the ears to assure sufficient deformation of the wire and the electrical terminal.

A method of forming an electrical connection according to the present invention, thus, requires only the steps of wrapping a lead wire around one of the ductile ear members extending from the electrical terminal **10** and bending the ductile member against the electrical terminal to deform a portion of the ductile member and permanently fix the wire to the electrical terminal.

The electrical terminal **10** can be easily and inexpensively formed as a stamping of any suitable electrically conductive, ductile material, such as steel with a tin-zinc plating, and the strip of material forming the electrical terminal can have any desired configuration conforming to the requirements for a desired application as long as the terminal has a portion defining an edge against which a ductile member extending from the terminal can be clamped after a lead wire is wrapped therearound such that the edge of the ductile member is deformed to accommodate the lead wire. That is, the configuration of the shank portion is designed to permit the electrical terminal to be secured to an electrical appliance; and, thus, the apertures and lugs can be positioned at any place and in any number desirable for a specific application. While only the edge around which the lead wire is wrapped is illustrated as being deformed during clamping of the ears against adjoining edges of the electrical terminal, the adjoining edge and the lead wire, to some extent, can be deformed during clamping to accommodate the lead wire. The ductile nature of the ears permits the edges thereof to set after deformation; and, thus, in order to increase permanence of the resulting electrical connection and to decrease costs, the electrical terminal **10** is advantageously integrally formed of a single strip of electrically conductive ductile material.

Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all matter described above or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An electrical terminal comprising

a strip of electrically conductive material having a first edge;

a first ductile member extending from said first edge, said first ductile member having a second edge adapted to have a lead wire wrapped therearound;

said strip having a third edge;

a second ductile member extending from said third edge, said second ductile member having a fourth edge adapted to have another lead wire wrapped therearound;

the first and second ductile members being bendable toward the first and third edges to clamp the second edge against the first edge and the fourth edge against the third edge;

said second edge of said first ductile member and said fourth edge of said second ductile member being deformable to accommodate lead wires wrapped around said first and second ductile members as said first and second ductile members are bent toward the first and third edges, said second edge is clamped against said first edge and said fourth edge is clamped against said third edge; and

said first and second ductile members having wedge-like configurations, the narrower end of each of one of said first and second ductile members being joined to said strip of electrically conductive material.

2. An electrical terminal as recited in claim **1** wherein said electrical terminal is integrally formed of a single strip of electrically conductive, ductile material.

3. An electrical terminal comprising

a strip of electrically conductive material having a first edge and a ductile member extending from said first edge, said ductile member having a second edge adapted to have a lead wire wrapped therearound and being bendable to be clamped against said first edge whereby said second edge of

said ductile member is deformed to accommodate the lead wire,

said strip of electrically conductive material having a third edge and a second ductile member extending from said third edge having a fourth edge adapted to have a lead wire wrapped therearound, said second ductile member being bendable to be clamped against said third edge whereby said fourth edge is deformed to accommodate the lead wire,

said first named ductile member and said second ductile member having inner edges meeting at an apex such that said ductile members can be bent toward each other to abut said inner edges and deform said inner edges to accommodate wires wrapped therearound, and

said first named ductile member and said second ductile member each having a wedge-like configuration with the narrower end joining said strip of electrically conductive material.

4. An electrical terminal as recited in claim 3 wherein said electrical terminal is integrally formed of a single strip of electrically conductive, ductile material.

5. An electrical terminal as recited in claim 4 wherein said strip of material has a longitudinal center and said electrical terminal is symmetrical about said longitudinal center.

6. An electrical terminal as recited in claim 5 wherein said first and third edges slant away from said longitudinal center in a first direction, said second and fourth edges slant away from said longitudinal center in a second direction opposite to said first direction, and said inner edges of said ductile members are angularly oriented relative to said longitudinal center such that when said first named ductile member is bent to abut said first and second edges and said second ductile member is bent to abut said third and fourth edges, said inner edges are disposed in a line transverse to said longitudinal center.

7. A method of forming an electrical connection comprising the steps of

wrapping a lead wire around an edge of a ductile member extending from an adjoining edge of an electrical terminal; and

bending the ductile member toward the adjoining edge of the electrical terminal to clamp the edge of the ductile member against the adjoining edge of the electrical terminal and deforming the edge of the ductile member to accommodate the wrapped lead wire between the adjoining edge of the electrical terminal and the deformed edge of the ductile member.

8. A method of forming an electrical connection with an electrical terminal having a first ductile member extending from an adjoining edge of the terminal and a second ductile member extending from another adjoining edge of the electrical terminal the first and second ductile members having opposed inner edges, said method comprising the steps of

wrapping a lead wire around the inner edge of the second ductile member,

bending the first and second ductile members towards each other to place the inner edges in abutment, and

deforming the inner edge of the second ductile member to accommodate the wrapped lead wire between the inner edge of the first ductile member and the deformed inner edge of the second ductile member.

* * * * *