United States Patent [19]

Philibert et al.

[11] **3,901,577**

[45] **Aug. 26, 1975**

[54] **GROUNDING CLAMPS AND CONNECTORS THEREFOR**

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[73] Assignee: **General Signal Corporation,** Rochester, N.Y.

[22] Filed: **Jan. 25, 1974**

[21] Appl. No.: **436,422**

[52] **U.S. Cl.** ..... **339/265 F**

[51] **Int. Cl.²** **H01R 7/26**

[58] **Field of Search** ..... 339/265 R, 265 F, 276 R, 339/263 L, 95

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Primary Examiner—Roy Lake
Assistant Examiner—E. F. Desmond
Attorney, Agent, or Firm—Milton E. Kleinman; Harold S. Wynn; John F. Ohlandt

[57] **ABSTRACT**

A versatile family of clamps, and associated or accessory connectors, are disclosed; such fittings being adapted to connect ground wires and other equipment to a source of ground potential. Also disclosed is a technique for fabricating parts of the clamping devices by means other than the commonly known casting techniques; that is, techniques according to which the parts are cast by utilization of sand cores. Instead, by judicious selection of external and internal parting lines for the mold used in the casting process, the present invention permits the elimination of such sand cores, which are expensive and require extremely precise formation.

8 Claims, 10 Drawing Figures

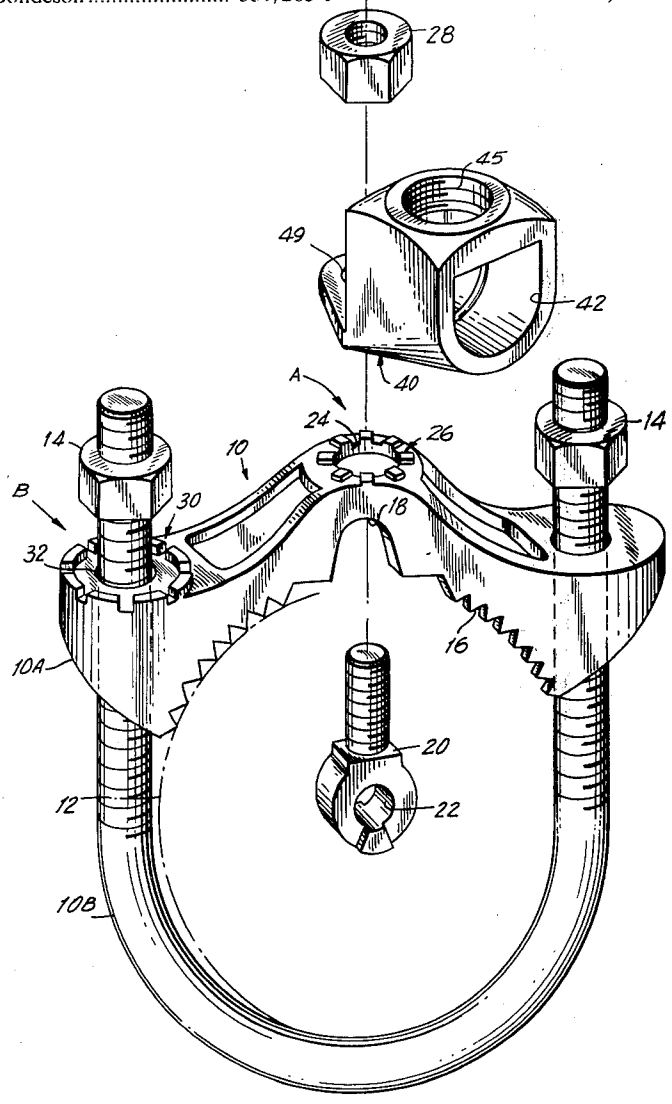


FIG. 1

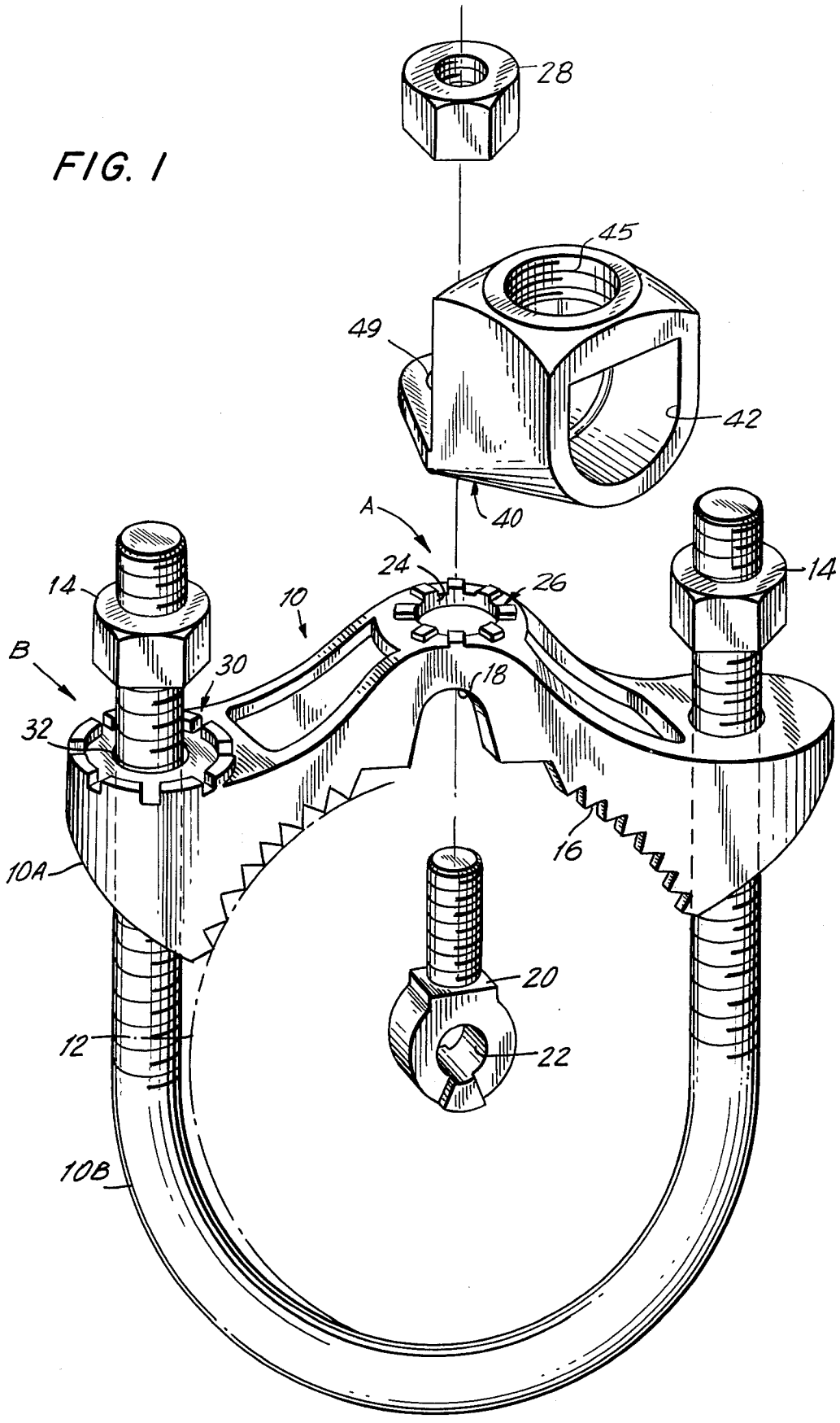


FIG. 2A

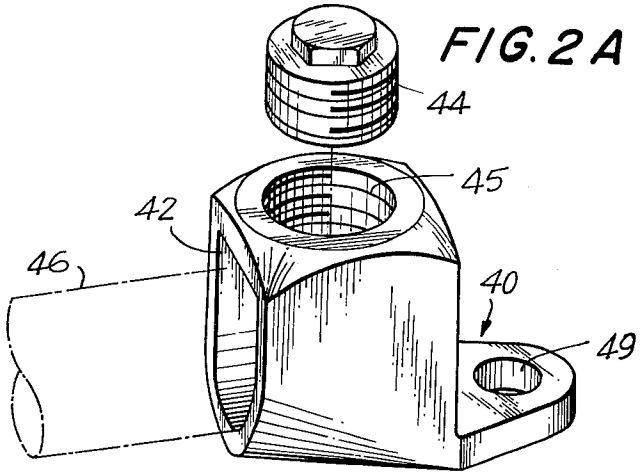


FIG. 2B

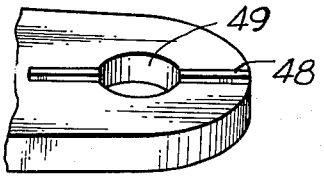


FIG. 2C

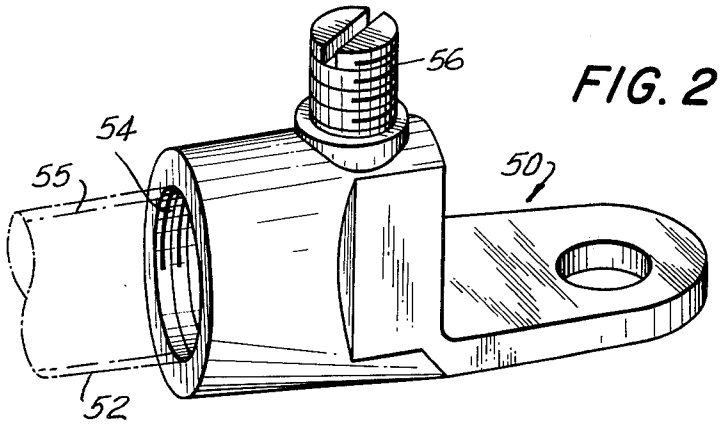


FIG. 2D

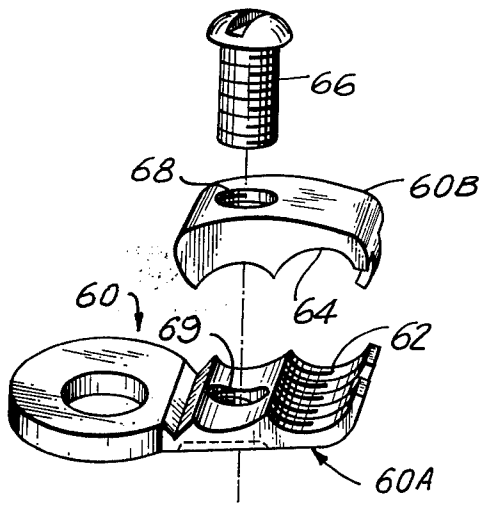
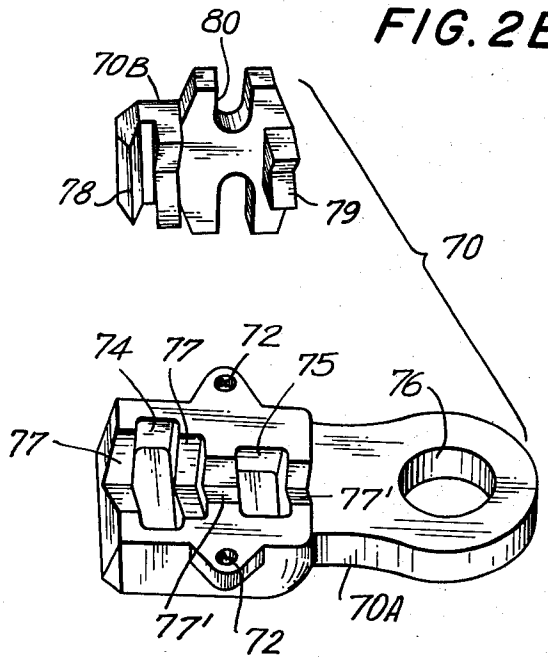


FIG. 2E



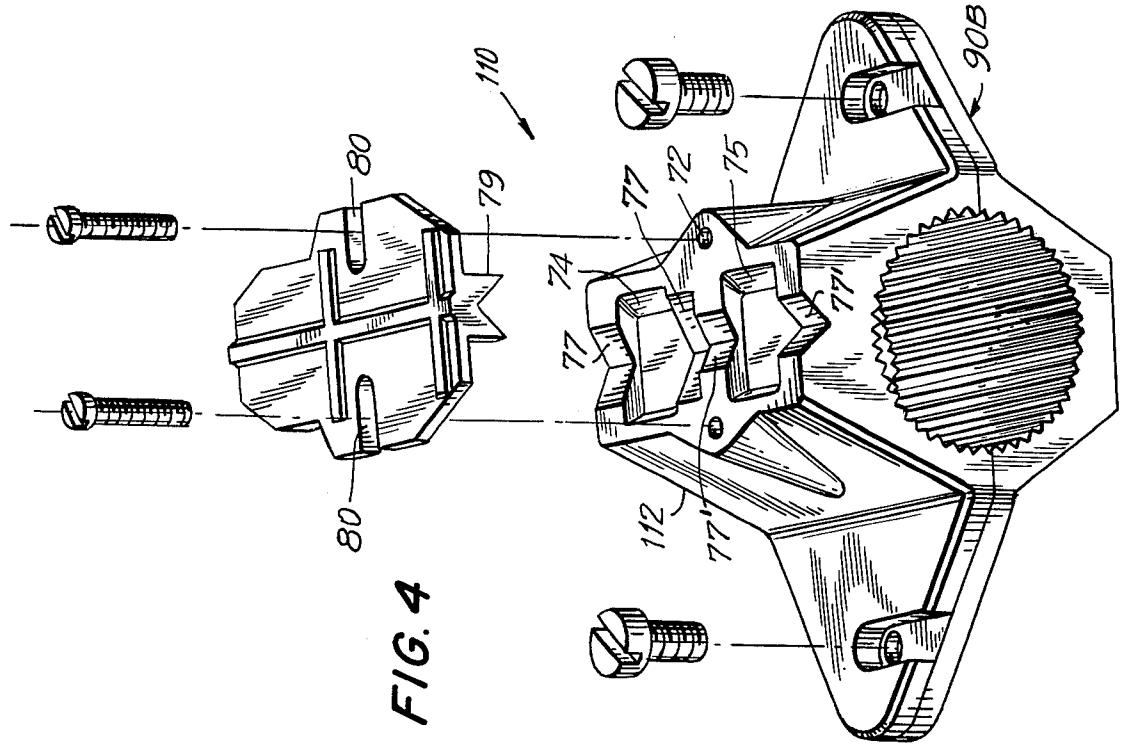

110
80
79
77
72
75
74
77'
77
90B
80
112
77'

FIG. 4

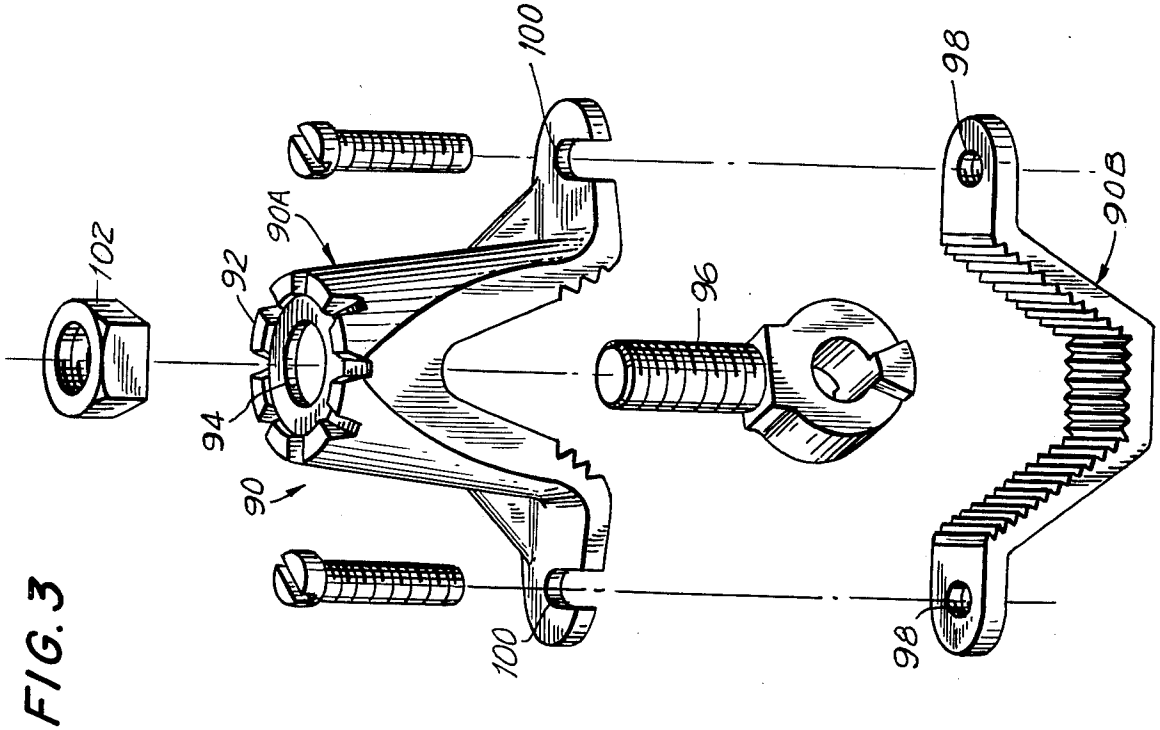

100
98
90B
102
92
90A
96
94
90
100
98

FIG. 3

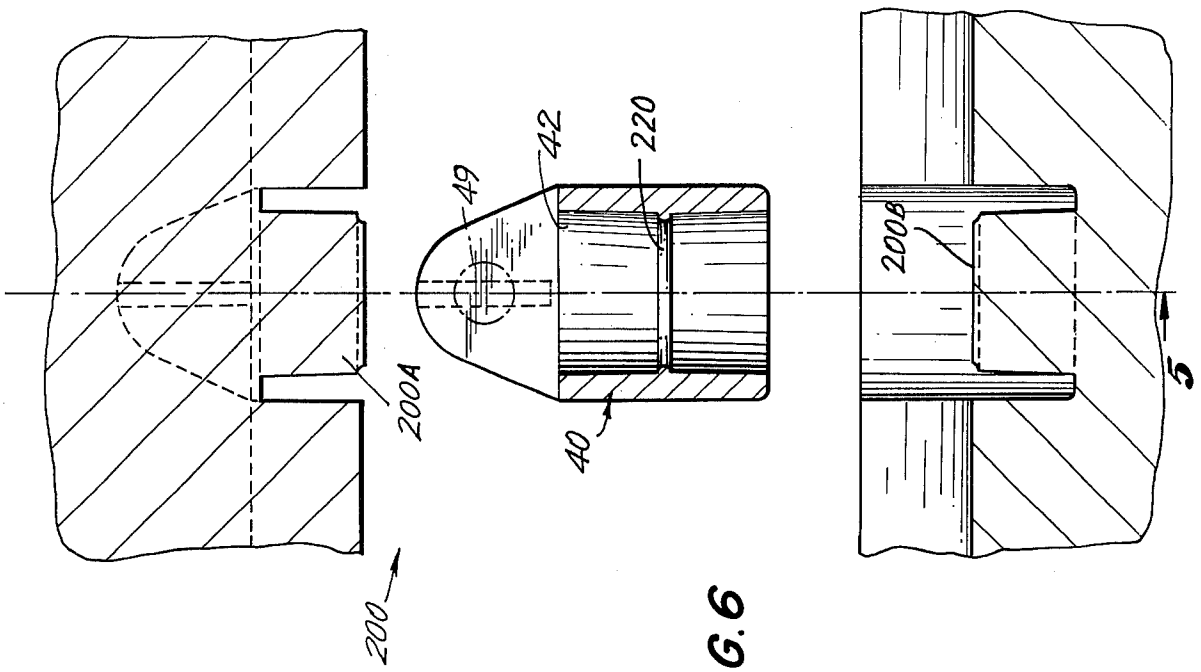
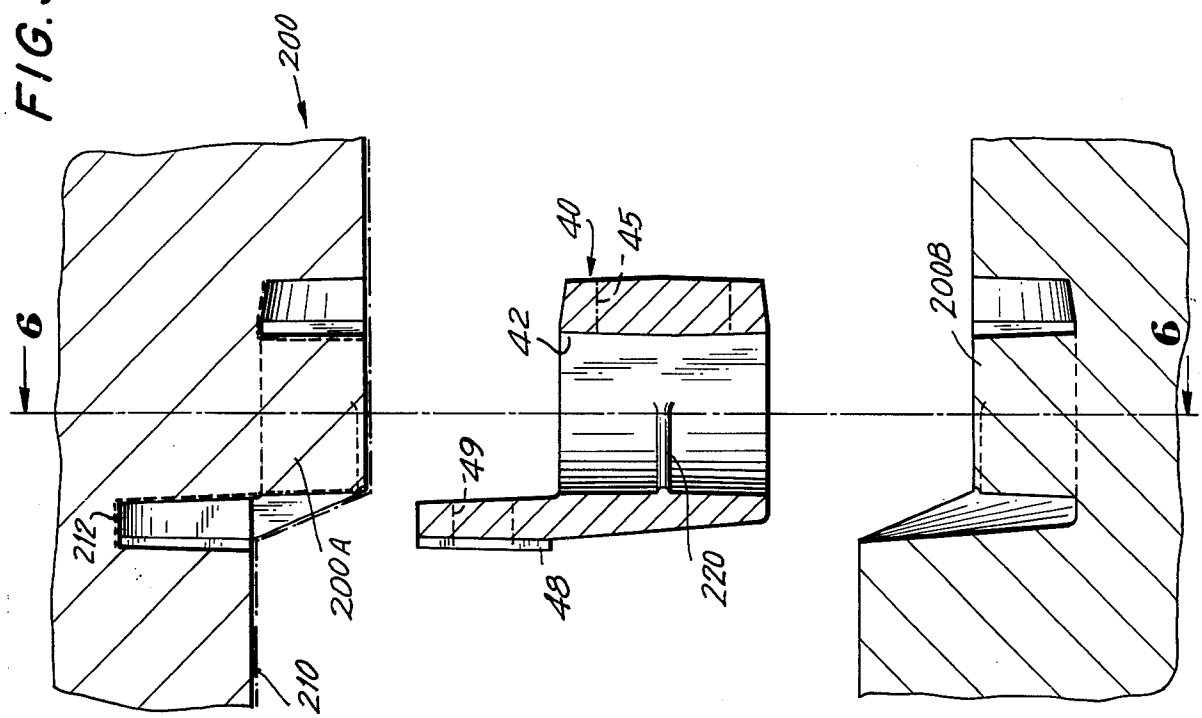

200
200A
49
42
220
40
200B
5

FIG. 6

FIG. 5


200
6
212
200A
210
40
45
42
49
48
220
200B
6

GROUNDING CLAMPS AND CONNECTORS THEREFOR

BACKGROUND, OBJECTS AND SUMMARY OF THE INVENTION

This invention pertains to electrical fittings and more particularly to clamping devices and connecting means associated therewith for making firm electrical contact, by means of grounding wires and the like, to a source of ground potential.

A number of techniques have been developed in the prior art for clamping different kinds of electrical equipment or devices of one type or another to a source of ground potential. One example of such a technique, and of the equipment used therewith, can be appreciated by reference to a 1970 catalog of the Gedney Electrical Company, Terryville, Conn., particularly at page 63 thereof.

However, a number of drawbacks and deficiencies have existed with prior art techniques and constructions and it is a primary object of the present invention to overcome these deficiencies. For one thing, many of the parts involved for the purpose of clamping to a cold water pipe or the like for grounding purposes are expensive to produce. This is for the reason that quite a bit of machining is necessary with such parts.

Accordingly, it is a major object of the present invention to reduce the machining necessary to a minimum and to enable the casting of parts for the clamping devices and associated connectors, including forming the holes required for the purpose of securing parts together.

It is also a particular deficiency of the prior art that clamping devices used for the purpose of clamping the ground wire, or both the ground wire and the armor which sometimes surrounds the ground wire, to the ground potential have involved the use of too many screws in fastening or tightening down on the armor and the ground.

Accordingly, it is another object of the present invention to provide for clamping of both the armor and the ground wire by the use of only two screws and to do so in a single simple operation. Such technique contrasts sharply with prior art constructions in which two separate clamping operations are involved.

As also indicated previously, the clamping device for clamping both the armor and the grounding wire includes a clamping member which is a cast part. Consequently it is only necessary, following the casting process, to take the cast part and to drill and tap therein only two holes to receive the screws required for clamping down on both the armor and the grounding wire. This arrangement constitutes a principal feature of the present invention.

Also included as part of the clamp for clamping down on both the armor wire and the ground wire is a cap or cover piece which is provided with projections that fit into the recesses formed in the cast member. This cap or cover piece is able to rock or shift in accordance with the different sizes of wire, whether solid or stranded, for both the grounding wire and the armor wire, that is, in accommodating each to its particular recess formed in the cast part.

Another aspect or feature of the present invention resides in the provision for accommodating a variety of accessory connectors in conjunction with the clamping device so that a variety of different equipment or devices can be connected to the source of ground potential. In other words, the present invention affords great versatility and flexibility in providing that a standardized part or member of the clamping device can accept different accessories at different locations for connecting different kinds of equipment to ground potential.

In broadly stated terms, then, the present invention may be characterized as a clamping device for clamping to ground potential and connecting a variety of devices thereto comprising: a pair of clamping members, at least one of which is a cast member, for fitting around a water pipe or the like; means for clamping said pair of members to the pipe or the like independently of the connection to said clamping device of the equipment to be grounded; and means for connecting said equipment to be grounded, including said cast member which is shaped to receive means for firmly securing said equipment to said clamping device.

The above characterization of the invention brings out another essential feature, namely, that there is complete independence between the physical clamping action to the water pipe or the like and the connection of a grounding wire, and associated equipment, or the connection of both a grounding wire and armor wire, to the accessory connector so that the ground potential will be properly connected.

The above and other objects, features and advantages of the present invention will be understood by reference to the following detailed specification, taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of a first preferred embodiment of a clamping device in accordance with the present invention.

FIG. **2A** is a perspective view of one of the accessory connectors or connecting lugs to be associated with the clamping device of FIG. **1.**

FIG. **2B** is a fragmentary bottom plan view of the connecting lug of FIG. **2A.**

FIG. **2C** is a perspective view of another connecting lug for accommodating rigid conduit and bare ground wire.

FIG. **2D** is another form of connector lug suitable for through-ground wires.

FIG. **2E** is yet another form of connector lug for accommodating bare ground wires and armor.

FIG. **3** is another preferred embodiment of a clamping device in accordance with the present invention, such device being composed of two cast members.

FIG. **4** is yet another embodiment of a clamping device, similar in style to the device of FIG. **3,** but having included therein recesses in the upper cast member for receiving ground wire and surrounding armor.

FIGS. **5** and **6** illustrate the technique of casting a typical accessory connector.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawing, and in particular for the moment to FIG. **1** thereof, there will be seen a first preferred form or embodiment for the clamping device of the present invention. The device per se is generally designated **10,** being constituted of a pair of clamping members **10A** and **10B.** In this particular embodiment the member **10A** is a cast member, being composed of malleable iron, hot dip galvanized or including copper alloy. The other part of member **10B** is formed as a U-

bolt and is generally composed of steel, hot dip galvanized or copper alloy. The U-bolt **10B**, as will be seen, fits around a cold water pipe **12** shown in phantom outline. The two members **10A** and **10B** are secured together by means of a pair of nuts **14,** which are also typically composed of steel or copper alloy. Firm and fixed mechanical contact with the pipe **12** is assured by the serrated edges at the bottom surface of the member **10A** which serrated edges are disposed near the periphery of the member, at both the front and the rear wall or flange portions **16** thereof. The serrated edges also assure good grounding contact by penetrating the surface skin of the pipe.

A pair of slots **18** are provided at the center of the front and rear walls of the member **10A** so as to permit ready connection of a grounding wire, not shown, which is arranged to fit through the eye stud **20**; that is, through the opening therein **22** for this purpose. The eye stud **20** fits through an opening or aperture **24** which extends to the upper part of the member **10A**, the upper surface thereof being provided with a spaced-segment boss **26** which surrounds the opening **24.** A nut **28** is provided for threaded engagement with the eye stud **20,** thereby to retain and secure the grounding wire firmly against the underside of the clamp member **10A** within the notches **18.**

It will be appreciated that the eye stud **20** is not only used selectively for securing such grounding wire but serves as a bolt in those cases where a variety of accessory connectors, to be described, are disposed at the boss **26** for connection to the clamp member **10A.** Such accessory connectors are illustrated in FIGS. **2A–2E.**

What will be especially appreciated from the foregoing is the unique feature of the present invention by which the clamping members can be attached to the cold water pipe or the like independently of the connection of equipment, such as grounding wires or the like to the clamping device **10.** Thus, the eye stud **20** will be inserted in the aperture **24,** and before connection of the grounding wire, by means of accessory connectors, is actually accomplished, the nuts **14** at the end of the U-bolt **10B** will have been tightened down at the edge of the cast member **10A.**

Another spaced-segment boss **30** is provided at one end of the cast member **10A,** being of similar construction to the previously described boss **26** and affording an alternate point or position for attachment of the accessory connectors. This boss surrounds one of the openings **32** formed at the ends of member **10A** through which the end of the U-bolt **10B** pass.

Accordingly, it will be apparent that the advantage of versatility is present in the clamping device of the present invention because a variety of these accessory connectors, which are adapted to accommodate different equipment, can be attached or connected to the basic clamping device at several points or locations thereon. For convenience, the central position at which boss **26** is formed is referred to as position A and the peripheral position as position B. Further versatility lies in the fact that the clamping device is complete with respect to its function in clamping to a cold water pipe or the like, and yet, with the given device, a variety of sizes of accessory connectors can be readily utilized. In other words, the clamping device does not have to be disassembled or rearranged to permit connection thereto of a variety of different sizes and types of equipment.

Referring now to FIGS. **2A–2E** a number of examples of different types of accessory connectors is therein illustrated. In FIG. **2A** there is shown a connector **40** especially adapted for accommodating bare ground wires and the like in a "dead-end" connection. Thus a bare ground wire is inserted into the connector through the opening **42** and the screw **44** is tightened down on the end of the ground wire **46,** shown in phantom outline. FIG. **2B** shows the underside of the connector **40** and particularly illustrates the provision of a rib **48** extending longitudinally at the periphery of the opening **49.** It will be understood of course that the opening **49** is lined up with the opening **24** to permit passage of the eye stud **20** therethrough when the connector **40** is to be attached at position A to the clamp **10** (see FIG. **1**). The rib **48** fits snugly within the spaces between the segments of the boss **26** and insures a firm engagement therewith. Alternately, the opening **49** of the connector can be lined up with the opening **32** at the center of boss **30.**

There is shown in FIG. **2C** another form of accessory connector **50.** In this instance, provision is made for accepting rigid conduit as well as the ground wire that is to be connected to the cold water pipe. The rigid conduit **52,** showin in phantom outline, is received within the threaded opening **54** and the ground wire **55** is secured by means of the screw **56** which is tightened down thereon. The underside of the connector **50** is, like the connector **40** in FIG. **2A,** provided with a longitudinal rib for purposes already explained.

FIGS. **2D** and **2E** show other forms of connectors **60** and **70,** respectively, both of which are adapted to be secured to the clamp **10** in the manner already indicated, that is, at either position A or position B thereof. The connector **60** of FIG. **2D** is adapted to provide for securing of a bare ground wire which extends to other pieces of equipment, that is, the groundwire is not dead-ended, as the case with the connector of FIG. **2A,** but rather common connection of ground potential to multiple pieces of equipment is accomplished by means of the single, extended ground wire. For this reason, the lower member **60A** is provided with an open ended channel or groove **62** and the upper member **60B** with a corresponding channel or groove **64.** Both channels or grooves are ribbed to provide firm securing to the ground wire. The upper member or cap **60B** is secured by means of the screw **66** which is received in the apertures **68** and **69** in the respective connector members **60B** and **60A.**

The connector **70** embodies that feature of the present invention which fullfills the objective of a connector for clamping in a simplified manner both armor and grounding wire to the ground potential. The connector **70** comprises a lower member **70A** and an upper member or cover **70B,** both of these members being cast members, that is, they are formed by a casting technique to be described hereinafter. The result of this casting technique is that only two holes or apertures **72** need to be drilled and tapped for the reception of screws in securing either a bare ground wire or the combination of armor and ground wire. It should be noted that the connector **70** can accommodate three different sizes of wires, whether they be solid or stranded.

In its specific construction the connector **70** includes two separate compartments or recesses **74** and **75.** The recess **75,** which is closer to the opening **76,** is not as

wide as recess **74.** Each of the recesses **74** and **75** is flanked by a pair of V-shaped notches **77** and **77'** respectively in which the respective wire or armor will be firmly engaged. The notch **77** extends to a greater depth than the notch **77'** and is also broader, thereby to accommodate the larger equipment, i.e., the armor.

The cover **70B** is provided with corresponding teeth-like projections **78** and **79** which also have V-shaped notches therein, such notches fitting over and thereby engaging the respective armor or ground wire accommodated by each of the respective recesses **74** and **75.** U-shaped notches **80** are provided at the sides of the cover **70B** so as to permit appropriate screws, not shown, to be accommodated and thereby to hold down the cover **70B** when the screws are inserted in the openings **72** and are tightened down. As noted previously, the cover **70B** is capable of rocking to some extent so as to permit securing of varying sizes of armor and ground wire.

Turning now to FIG. **3** of the drawing, there is shown therein another preferred embodiment of the clamping device in accordance with the present invention. In this embodiment, the clamping device **90** consists of two principal parts, an upper cast member **90A** and a lower cast member **90B.** The upper member shares with the embodiment of FIG. **1** the general feature of a centrally located boss **92** which is similar to the boss **26** in FIG. **1.** The boss **92** comprises a plurality of segments which surround a centrally located aperture **94** adapted to receive an eye stud **96** (substantially the same as the eye stud **20** previously discussed in connection with FIG. **1**). Accordingly, the embodiment of FIG. **3** possesses the same basic advantage, namely that of being able to tighten the clamping device on the cold water pipe or the like for grounding purposes, independently of the operation of actually securing an accessory connector or the like to the boss **92.**

It should also be noted that, rather than the lower member taking the form of a U-bolt as in FIG. **1,** the lower member **90B** can also be cast member suitably provided with a ribbed structure for slip-proof engagement with the cold water pipe. The lower member **90B** is provided with a pair of holes **98** which in securing the clamp are lined up with the open-ended grooves or channels **100** in the upper member **90A.**

As before, the eye stud **96** is placed in position so that its threaded shank extends through the aperture **94** and then, any one of the previously described accessory connectors, that is, any of the lug connectors depicted in FIGS. **2A–2E,** can be selectively positioned at the boss **92** — following securement of the clamping device — and the eye stud shank will extend through the suitable openings in the accessory connectors. Following this, the nut **102** is tightened down on the eye stud **96.** Alternately, a suitable grounding wire may be attached to the clamp **90** by being fitted through the opening in the eye stud **96** and thence secured firmly against the underside of the upper clamp member **90A** when the nut **102** is tightened properly.

Referring now to FIG. **4,** yet another embodiment is depicted in which a clamping device **110** is seen. Since this device utilizes the same lower part as the embodiment of FIG. **3,** the same numeral **90B** refers to this lower part. However, the upper part is designed specifically for the purpose of receiving either a bare ground wire or the combination of armor and ground wire, as was advantageously seen in the accessory connector of FIG. **2E.** Thus, although the numeral **112** designates the upper part or member, the same numerals as in FIG. **2E** refer to like parts, for example, to the several recesses provided, as well as the other internal structure for receiving the equipment in the form of the armor or the ground wire.

Referring now to FIGS. **5** and **6** the technique of the present invention for casting the accessory connectors and like parts will be understood. This technique permits the casting of the connectors without the utilization of sand cores, which is the conventional method. Instead, the required configuration or structure for the connectors is achieved in a vertical casting process, simply as a result of judicious selection of external and internal parting lines for the mold. Such technique permits very economical and extremely fast casting of the required parts, that is, of the accessory connectors, because of the elimination of sand cores.

There will be seen in FIGS. **5** and **6** several views of the sand mold involved in the instant technique, including the connector **40** fabricated therein. The connector **40** is the same as the connector previously illustrated in FIG. **2A,** which is a connector intended for use with "dead-end" bared ground wires. As already explained previously, the opening **42** is provided for the ground wire, while the opening **49** accommodates the eye stud **20** used in connecting the connector **40** to the clamping device **10.**

It will, of course, be understood that the connector **40** is merely exemplary of the variety of connectors that can be fabricated in the manner to be described. Connectors of this type are generally fabricated of malleable iron with a hot dip galvanized finish.

The accessory connector **40** illustrated in FIGS. **5** and **6** is cast in the sand mold **200,** which is made from bonded sand in such a way that liquid metal poured into it will, after solidification, retain the mold shape and can be separated from it.

It will be understood that the mold **200** consists of two portions, the upper portion being called the cope **200A** and the lower portion being called the drag **200B.**

In the technique of the present invention, the correct mold form is obtained by using what is called a match plate pattern. Thus, rapid production is facilitated by mounting the drag half of a pattern on one side of a wood or metal plate and the cope half directly opposite on the reverse side. This plate is attached to the drag flask and used like a follow board when ramming the drag; the cope sand is rammed against the reverse side. Finally the match plate pattern is removed, leaving a cope and drag that match perfectly at the parting line. The gates are generally made by the pattern at the same time.

It will be seen in FIGS. **5** and **6** that the cope and drag meet and match at the parting line; the external parting line is shown by means of broken line **210,** while the internal or interior parting line is shown in the same way by means of the broken line **212.** These parting lines are irregular but are carefully arranged so that a requisite structural feature of the accessory connector **40** can be realized. This feature enables the connector to meet the stringent pull-out requirements imposed by Underwriters' Laboratories, namely, that the ground wire which is to be retained or held by the connector **40** cannot be pulled out by a force less than the specifications call for. To this end an interior or internal rib

220, is formed, which extends around the inner surface of the central opening 42 defined in the finished connector 40. This rib 220 is formed one-half within the cope and one-half within the drag of the sand mold.

While there has been shown and described what is considered at present to be the preferred embodiment of the present invention, it will be appreciated by those skilled in the art that modifications of such embodiment may be made. It is therefore desired that the invention not be limited to this embodiment, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A clamping device for clamping to ground potential and for connecting equipment to such potential, comprising:

a pair of clamping members for fitting around a water pipe or the like;

means for clamping said members to the pipe or the like independently of the connection to said clamping device of the equipment to be grounded;

means for connecting said equipment to be grounded, including one of said clamping members, which is shaped to receive means for firmly securing said equipment to said clamping device; and further including a threaded bolt or eye stud having an opening therein, said one clamping member including a web and a pair of spaced parallel flanges depending from said web, said web and said flanges together defining a raised arched portion at the crest of which an aperture extends perpendicular to and through said web so that said threaded bolt or eye stud can be disposed in said aperture and a grounding wire can be put through said opening in said bolt or eye stud and secured against said raised arched portion.

2. A device as defined in claim 1, in which the other of said clamping members is provided with screw-receiving holes.

3. A device as defined in claim 1, in which the other clamping member is a U-shaped bolt, said one clamping member having apertures provided at either end thereof for receiving the ends or shanks of said bolt.

4. A clamping device as defined in claim 1, in which a slot is provided in each of said spaced flanges so that said grounding wire can be received therein.

5. A clamping device as defined in claim 4, including a spaced-segment boss surrounding said aperture at the upper surface of said web, said spaced-segment boss being adapted to receive a variety of connector devices.

6. A clamping device as defined in claim 5, in which said connector devices include a ribbed member extending longitudinally at opposite sides of an opening provided therein, said ribbed member being adapted to fit into spaces between segments of said boss.

7. A clamping device for clamping to ground potential and for connecting equipment to such potential, comprising:

a pair of clamping members for fitting around a water pipe or the like;

means for clamping said members to the pipe or the like independently of the connection to said clamping device of the equipment to be grounded;

said equipment to be connected including a grounding wire and an armor shield;

a connector device, comprising a lower member having individual recesses spaced along its longitudinal axis in spaced relation to the armor and the grounding wire respectively; a cap or cover, having its longitudinal axis in a single plane and extending parallel to and in the same vertical plane as the longitudinal axis of said lower member, said cap or cover member fitting over said recesses in the lower member and including individual corresponding projections for bearing down within said recesses on the armor and grounding wire respectively; and a pair of screw-receiving openings in said lower member, said openings being located at the sides thereof and intermediately of said recesses along the longitudinal axis of said lower member; a first pair of notches flanking the recess for said armor, and a second pair of notches flanking the recess for said grounding wire, the first pair of notches having a greater depth than the second pair whereby said armor and grounding wire are securely held within said connector device.

8. A clamping device as defined in claim 7, in which said lower member of said connector device is constituted by said one clamping member.

* * * * *