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
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 simple single 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 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-
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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 connector 40, 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, shown 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 fulfills 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 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 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
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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 cover or cap 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 immediately 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.

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