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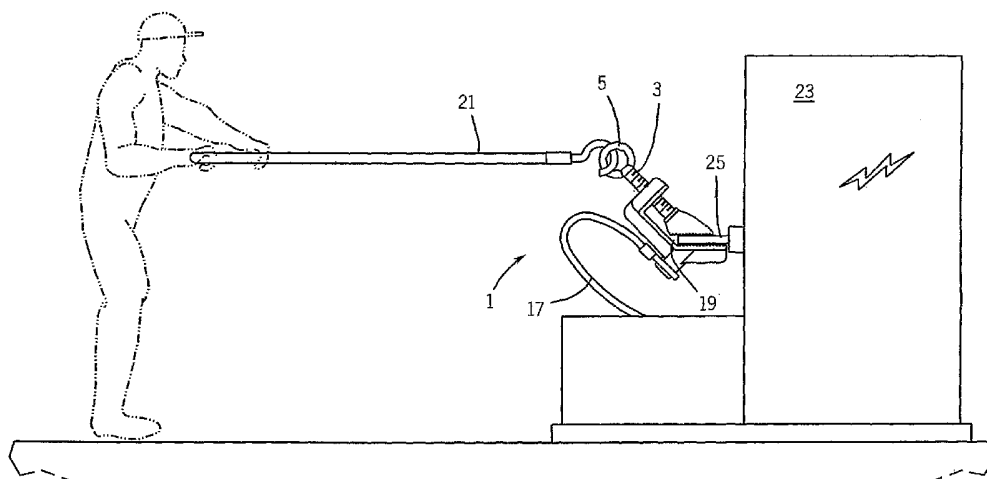
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(54) Title: GROUNDING CLAMP APPARATUS AND METHOD



(57) Abstract: A grounding clamp provides a direct connection to ground between a power transmission or power distribution apparatus and a nearby ground plane. As a grounding clamp is being attached to the mating interface of a power transmission or power distribution apparatus, the angled gripping surfaces permit an operator to ground the spade from a distance of live-line tool's length from the frontplate of the power apparatus and apply the requisite pressure to the mating interface, providing an easier to attach grounding clamp and a more secure ground connection.

GROUNDING CLAMP APPARATUS AND METHOD

BACKGROUND

[0001] The present invention relates generally to the field of grounding devices. More particularly, this invention relates to enhancements in grounding devices for securing a connection between a potentially energized apparatus and a ground point, while increasing the ease of use of such devices.

RELATED ART

[0002] Typically, the distribution of power begins at a power generation facility, such as a power plant. As the power leaves the power plant, it enters a transmission substation, where a transformer converts it up to extremely high voltages for long-distance transmission. Then the power is transmitted over high-voltage transmission lines and is later converted down to distribution voltages that will allow it to be useful to ordinary residential or commercial customers. After the power is converted, the power is transmitted over power lines that typically lead to a switchgear. The switchgear sectionalizes the power amongst various customers in a particular subdivision. The power is then sent to another transformer and reduced from 7,200 volts, which is the voltage typically delivered over a distribution bus line, down to the 240 volts necessary for ordinary residential or commercial electrical service.

[0003] Grounding clamps are used to connect the mating interface of a power transmission or power distribution apparatus to a nearby ground point. Such a grounding operation is necessary to perform maintenance operations on the mating interface of a power transmission or power distribution apparatus. For instance, examples of such power transmission or power distribution apparatuses could be in the form of a transformer, a switchgear, a sectionalizing cabinet, or other similar equipment performing a like function. For example, a transformer's general purpose is to convert the power transmitted from an energy source to a receiving device to a useful level for service or distribution. In many cases, a transformer reduces high-distribution voltages down to appropriate levels for residential or commercial customers. In other cases, a transformer can boost the generated voltage up to extremely high levels for long-distance transmission. In both cases, such

transformers invariably require maintenance. In performing maintenance to a transformer, the mating interfaces, generally, should be grounded.

[0004] Power distribution apparatuses typically distribute power through mating interfaces such as universal wells and spades. The universal wells distribute high-voltage power, while the spades distribute low-voltage power. Such apparatuses typically have several spades. In most cases, a spade is torqued into the low-voltage bushing wells, and its primary purpose is to distribute low-voltage power to customers. For example, each spade can send power to several customers in a subdivision. However, when a spade requires maintenance or when an additional customer requires a connection to the apparatus, an operator typically grounds the spade in order to perform such operations.

[0005] The process of grounding the mating interface of a power apparatus typically involves a line-crew operator connecting the clamp's grounding cable to a ground rod and mounting the clamp on the spade. Typically, the clamps are provided as C-clamps, with a C-shaped body and a rod inserted through an opening in the C-shaped body. The rod can be turned primarily at one end, in order to increase the pressure exerted on the mating interface by the clamp. When mounting the clamp on a mating interface, the operator typically clamps the mating interface at an angle, referred to as the grasping angle, in order to achieve the necessary surface contact with the mating interface. The grasping angle is the angle of approach for the gripping surfaces of the clamp to grasp a mating interface. Due to the confinements of the grasping angle, it is necessary that an operator work in close proximity to the frontplate or tank wall of the power apparatus to attach or remove the clamp from the mating interface. Nonetheless, it is desirable for an operator to be able to maintain distance from the frontplate or tank wall of the power apparatus when performing such operations.

[0006] Accordingly, it should be advantageous to provide a grounding clamp configured to allow for easier removal of the grounding clamp at a distance from the frontplate or tank wall of a power transmission or power distribution apparatus. It would be desirable to provide a grounding clamp and method or the like of a type disclosed in the present application that includes any of these or other advantageous features. It should be appreciated, however, that the teachings herein may also be applied to achieve devices and methods that do not necessarily achieve any of the foregoing advantages but rather achieve different advantages.

SUMMARY

[0007] In accordance with one embodiment of the present invention, a grounding clamp comprises a rigid member with a first end and second end and a moveable member inserted through the second end of the rigid member. The moveable member repositions in relation to the first end of the base for clamping with the first end of the base. The first end of the rigid member is configured such that it is not perpendicular to the axis of motion of the moveable member.

[0008] Still other advantages of the present invention will become readily apparent to those skilled in this art from review of the enclosed description, wherein the preferred embodiment of the invention is disclosed, simply by way of the best mode contemplated, of carrying out the invention. As it shall be understood, the invention is capable of other and different embodiments, and its several details are capable of modifications in various respects, all without departing from the invention. Accordingly, the figures and description shall be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a side view of a grounding clamp wherein the C-shaped body has an inner surface with a grasping angle between one-hundred degrees (100°) and less than one hundred and eighty degrees (180°).

[0010] FIG. 2 is an aerial view of the field of use of the grounding clamp with a power apparatus, wherein it is illustrated that the grounding clamp has a grasping angle within the range of one-hundred degrees (100°) and one hundred and eighty degrees (180°).

[0011] FIG. 3 is side view of the field of use of the grounding clamp with a power apparatus, wherein it is illustrated that the grounding clamp has a grasping angle within the range of one-hundred degrees (100°) and one hundred and eighty degrees (180°).

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0012] Referring to FIG. 1, a grounding clamp 1 is illustrated with an enhanced grasping angle 19. Enhanced grasping angle 19 increases the ease of use of a live-line tool with a

grounding clamp 1 for applying pressure to mating interface of power apparatus, such as spade 25 (shown in FIGS. 2 and 3). Grounding clamp 1 is comprised of C-shaped member 2 with a concave inner surface. C-shaped member 2 also has a first end 13, second end 15, and mid-section 14. C-shaped member 2 has an enhanced form, such that the intersection of first end 13 with mid-section 14 result in angle within the range of one-hundred degrees (100°) and one hundred and eighty degrees (180°). FIG. 1 is demonstrative of the embodiment achieved when first end 13 and mid-section 14 intersect at an angle within the preferred range. Grasping angle 19 is ergonomically designed to permit a line-crew operator to apply torque to rod 3, while maintaining the desired clearance between each mating interface and while standing a live-line tool's length away from the power apparatus.

[0013] Additionally, the second end 15 of the C-shaped member 2 intersects the opposite end of mid-section 14. The angle created by this intersection is approximately ninety degrees (90°) in the illustrated embodiment, although other configurations may be used. Although C-shaped member 2 is herein disclosed as multiple elements, it may be molded, welded, or cast as a single unit to achieve the same result. Grounding cable 17 is attached to C-shaped member 2. Grounding cable 17 is connected to a nearby ground point for a secure connection to ground.

[0014] First gripping surface 9 is formed on the inner surface of the first end 13 of C-shaped member 2. Since it is formed to first end 13, first gripping surface 9 is also correspondingly angled between one-hundred degrees (100°) and one hundred and eighty degrees (180°), in relation to the intersection of first end 13 and mid-section 14. First gripping surface 9 can be formed to the inner surface by most typical means of assembly including, without limitation, molding, welding, casting, gluing, bolting, screwing, fastening, clamping, or being formed integrally with C-shaped member 2, although other arrangements may also be used. On the second end 15, rod 3 is inserted through an aperture in second end 15 of C-shaped member 2. Rod 3 has a first end and second end, whereon rod 3 has a torque ring 5 affixed to second end of rod 3, through which a live-line tool 21 may be attached, as shown in FIG. 2. Torque ring 5 may also be implemented as a single molded component with rod 3.

[0015] As illustrated in FIG. 1, jaw 7 is attached to the first end of rod 3. Jaw 7 has an upper surface and a bottom surface, where the bottom surface is affixed to the first end of

rod 3. A second gripping surface 11 is affixed to the upper surface of jaw 7. Second gripping surface 11 is angled between one-hundred degrees (100°) and one hundred and eighty degrees (180°), similar to first gripping surface 9. First gripping surface 9 is aligned to meet up with second gripping surface 11 of jaw 7 when torque is applied to rod 3. Application of torque to rod 3 causes jaw 7 and second gripping surface 11 to advance in the direction toward first gripping surface 9. The movement of jaw 7 and second gripping surface 11 toward first gripping surface 9 allows pressure to be applied to a spade positioned between the gripping surfaces for secure grounding. Torque is applied by receiving a fastening hook of live-line tool 21 into torque ring 5 and by rotating torque ring 5 for increased pressure on spade 25. First gripping surface 9 and second gripping surface 11 can be provided in the form of most typical means for gripping surfaces, including without limitation, being serrated, knurled, curved, or flat, although other surface types may also be used.

[0016] As mentioned, the angle created by the intersection of first end 13 and mid-section 14 is referred to as the grasping angle 19. Grasping angle 19 is angled between one-hundred degrees (100°) and one hundred and eighty degrees (180°). More specifically, grasping angle 19 is the angle of approach at which the gripping surfaces of grounding clamp 1 clinch a spade. Grasping angle 19 allows the operator to apply torque to rod 3, while standing a live-line tool's 21 distance away from a mating interface in a power apparatus 23.

[0017] Referring now to FIGS. 2 and 3, the enhanced grasping angle 19 allows the operator to perform the grounding operation more easily with the combined use of live-line tool 21 and grounding clamp 1. The operator connects grounding cable 17 to a nearby ground point, in order to secure a ground connection. The operator maneuvers grounding clamp 1 onto spade 25. FIGS. 2 and 3 illustrate that torque ring 5 accepts a fastening hook of live-line tool 21. FIG. 2 provides an aerial view of the field of use of grounding clamp 1 with a power apparatus 23, wherein it is illustrated that grounding clamp 1 has a grasping angle 19 within the range of one-hundred degrees (100°) and one hundred and eighty degrees (180°). FIG. 2 further illustrates grasping angle 19 of grounding clamp 1 when spade 25 is rotated nearly vertical to the ground surface over which the power apparatus 23 is situated. FIG. 3 illustrates an operator applying torque to rod 3 with live-line tool 21 and completing the grounding operation while standing a live-line tool's 21 length away from

power apparatus 23. Grasping angle 19, which is preferably in the range of one-hundred degrees (100°) to one hundred and eighty degrees (180°), increases the combined ease of use of live-line tool 21 and grounding clamp 1. Grasping angle 19 assists the operator in applying torque to rod 3 with live-line tool 21, and the operator is able to maintain proper distance from spade 25 in power apparatus 23 cabinet, in order to apply torque when using grounding clamp 1.

[0018] Throughout the specification, numerous advantages of exemplary embodiments have been identified. It will be understood of course that it is possible to employ the teachings herein so as to without necessarily achieving the same advantages. Additionally, although many features are herein disclosed as multiple elements, it will be appreciated that such features could also be implemented by molding or casting processes to create the claimed feature as a single unit or assembled as separate components to achieve the same result. Further, although certain methods are described as a series of steps which are performed sequentially, the steps generally need not be performed in any particular order. Additionally, some steps shown may be performed repetitively with particular ones of the steps being performed more frequently than others, when applicable. Alternatively, it may be desirable in some situations to perform steps in a different order than described.

[0019] Many other changes and modifications may be made to the present invention without departing from the spirit thereof.

WHAT IS CLAIMED IS:

2 1. A grounding clamp comprising:
3 a rigid member including a first end and second end; and
4 a moveable member inserted through an aperture in the second end of the
5 rigid member, wherein the first end of the rigid member is not perpendicular to the
6 axis of motion of the moveable member.

7 2. A grounding clamp according to Claim 1, wherein the first end of the base
8 comprises a first gripping surface.

9 3. A grounding clamp according to Claim 1, wherein the moveable member
10 comprises a second gripping surface.

11 4. A grounding clamp according to Claim 1, wherein the moveable member
12 comprises a threaded, cylindrical rod, wherein the cylindrical rod is threadedly connected to
13 a plurality of threads formed within the aperture of the second end of the rigid member.

14 5. A grounding clamp according to Claim 1, wherein the moveable member has
15 an aperture formed therein which accepts the insertion of a fastening hook of a live-line tool
16 to facilitate the movement of the moveable member.

17 6. A grounding clamp according to Claim 1, further comprising a grounding
18 cable configured to connect the mating interface of the potentially energized apparatus to a
19 grounding point

20 7. A grounding clamp comprising:
21 a base including a first end and second end; and
22 a moveable member connected to the second end of the base for clamping
23 with the first end of the base;
24 wherein the grounding clamp is configured to clamp onto a mating interface
25 of a potentially energized apparatus with the use of a live-line tool, while the live-line tool is
26 positioned substantially parallel to the gripping surface of the clamp.

1 8. A grounding clamp according to Claim 7, wherein the first end of the base
2 comprises a first gripping surface.

3 9. A grounding clamp according to Claim 8, wherein the gripping surface is
4 serrated.

5 10. A grounding clamp according to Claim 7, wherein the moveable member
6 comprises a second gripping surface.

7 11. A grounding clamp according to Claim 10, wherein the gripping surface is
8 serrated.

9 12. A grounding clamp according to Claim 7, wherein the moveable member
10 comprises a threaded, cylindrical rod, wherein the cylindrical rod is threadedly connected to
11 a plurality of threads formed within an aperture of the second end of the base.

12 13. A grounding clamp according to Claim 7, wherein the moveable member has
13 an aperture formed therein which accepts the insertion of a fastening hook of a live-line tool
14 to facilitate the movement of the moveable member.

15 14. A grounding clamp according to Claim 7, further comprising a grounding
16 cable configured to connect the mating interface of the potentially energized apparatus to a
17 grounding point.

18 15. A grounding clamp according to Claim 7, wherein the first end of the base is
19 angled between one-hundred degrees (100°) and one hundred and eighty degrees (180°)
20 relative to the axis of motion of the moveable member.

21 16. A grounding clamp according to Claim 7, wherein the first end of the base is
22 angled between one-hundred and twenty degrees (120°) and one-hundred and sixty degrees
23 (160°) relative to the axis of motion of the moveable member.

24 17. A grounding clamp according to Claim 7, wherein the first end of the base is
25 angled between one-hundred and thirty-five degrees (135°) and one-hundred and forty-five
26 degrees (145°) relative to the axis of motion of the moveable member.

1 18. A method for grounding a potentially energized apparatus, the method being
2 implemented by a grounding clamp, comprising:

3 receiving a fastening hook of a live-line tool;
4 providing a connection to a grounding point; and
5 clamping onto a potentially energized apparatus, the clamping step being
6 performed while the live-line tool is substantially parallel to a ground surface over
7 which it extends.

8 19. The method according to Claim 18, further comprising receiving torque from
9 a live-line tool to advance a jaw to meet up with a gripping surface of the grounding clamp.

10 20. The method according to Claim 18, further comprising adjusting pressure
11 applied to the potentially energized apparatus based on torque received from a live-line tool.

12 21. A grounding clamp comprising:
13 a rigid member including a first end and second end; and
14 means for clamping a mating interface of a potentially energized apparatus to
15 the first end of the rigid member, wherein the first end of the rigid member is angled
16 between one-hundred degrees (100°) and one hundred and eighty degrees (180°)
17 relative to the axis of motion of means for clamping.

18 22. A grounding clamp according to Claim 21, further comprising means for
19 connecting the rigid member to a live-line tool, such that the live-line tool is positioned
20 substantially parallel to a ground surface over which it extends, while clamping onto a
21 mating interface of a potentially energized apparatus.

22 23. A grounding clamp according to Claim 21, further comprising means for
23 grounding a mating interface of a potentially energized apparatus, wherein the means for
24 grounding the mating interface interconnects the rigid member to a grounding point.

25 24. A grounding clamp according to Claim 21, further comprising means for
26 gripping a mating interface of a potentially energized apparatus.

27 25. A grounding clamp according to Claim 21, wherein means for gripping has a
28 serrated surface.

1 26. A grounding clamp according to Claim 21, wherein the first end of the rigid
2 member is angled between one-hundred and twenty degrees (120°) and one-hundred and
3 sixty degrees (160°) relative to the axis of motion of means for clamping.

4 27. A grounding clamp according to Claim 21, wherein the first end of the rigid
5 member is angled between one-hundred and thirty-five degrees (135°) and one-hundred and
6 forty-five degrees (145°) relative to the axis of motion of means for clamping.

7 28. A grounding clamp comprising:

8 a generally C-shaped member with three sections including a first end, a
9 second end, and a mid-section, wherein the first end of the C-shaped member
10 connects with a first end of the mid-section, forming an angle on the inner surface of
11 the C-shaped member measured between one-hundred degrees (100°) and one
12 hundred and eighty degrees (180°), and a second end of the C-shaped member
13 joined with a second end of the mid-section, opposite the intersection of the first
14 end;

15 a first gripping surface connected to the first end of the C-shaped member;

16 a jaw with an upper surface and a bottom surface, including a second
17 gripping surface on the upper surface; and

18 a rod inserted through an aperture in the second end of the C-shaped
19 member, wherein the rod is connected to the bottom surface of the jaw.

20 29. A grounding clamp according to Claim 28, wherein the first end, second end,
21 and mid-section are integrally formed as a single component.

22 30. A grounding clamp according to Claim 28, further comprising a cable to
23 provide a connection with a grounding point.

24 31. A grounding clamp according to Claim 28, wherein the rod comprises
25 advancing spiral threads, wherein the cylindrical rod is threadedly connected to a plurality
26 of threads formed within the aperture of the second end of the base.

1 32. A grounding clamp according to Claim 28, wherein the rod has an aperture
2 formed therein which accepts the insertion of a fastening hook of a live-line tool to facilitate
3 the movement of the jaw.

4 33. A grounding clamp according to Claim 28, wherein the rod is attached to the
5 jaw by a ball-and-socket-type joint.

6 34. A grounding clamp according to Claim 28, wherein the first and second
7 gripping surfaces are serrated.

8 35. A grounding clamp according to Claim 28, wherein the angle formed by the
9 first end of the C-shaped member and the first end of the mid-section is measured between
10 one-hundred and twenty degrees (120°) and one-hundred and sixty degrees (160°) relative
11 to the orientation of the potentially energized apparatus.

12 36. A grounding clamp according to Claim 28, wherein the angle formed by the
13 first end of the C-shaped member and the first end of the mid-section is measured between
14 one-hundred and thirty-five degrees (135°) and one-hundred and forty-five degrees (145°)
15 relative to the orientation of the potentially energized apparatus.

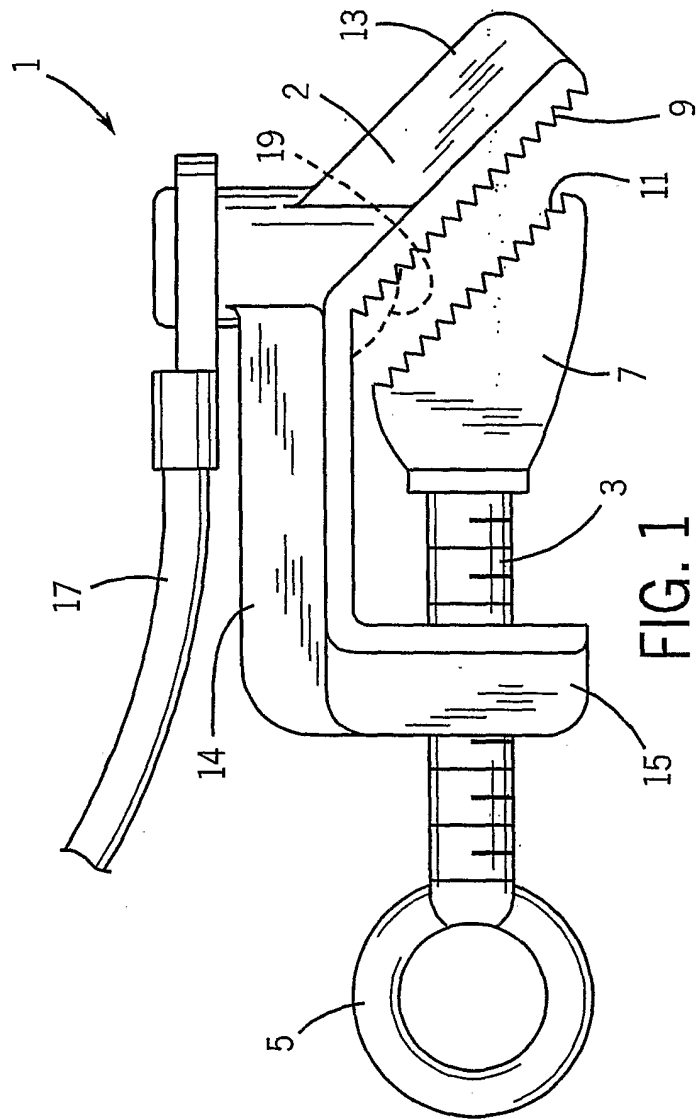


FIG. 2

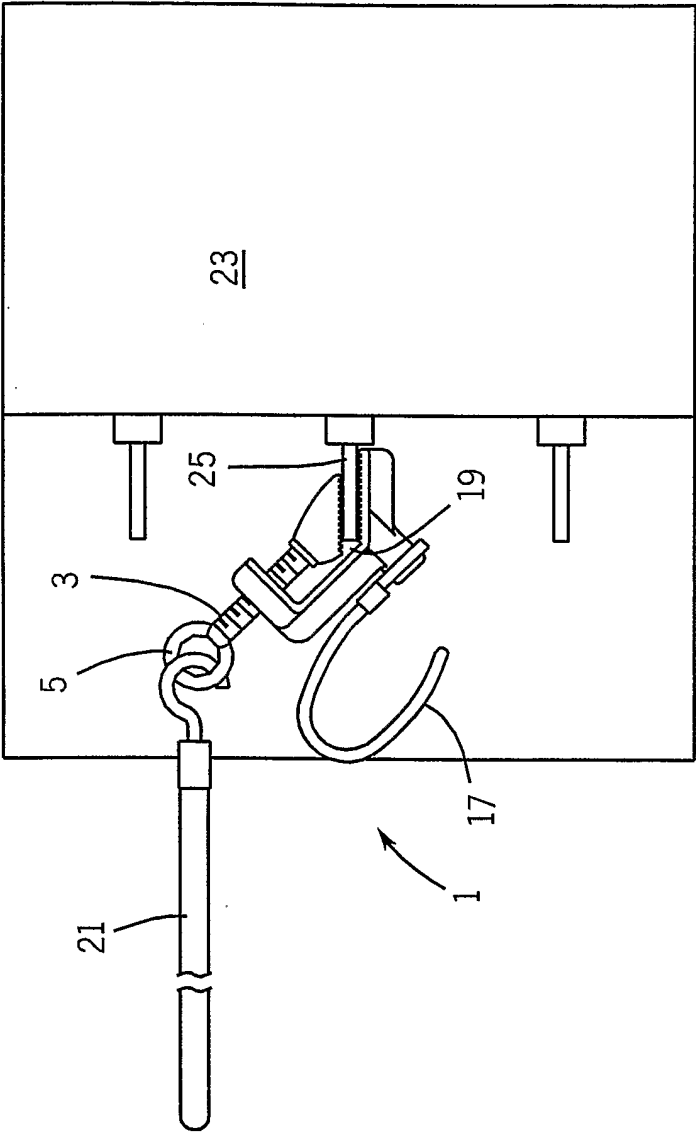
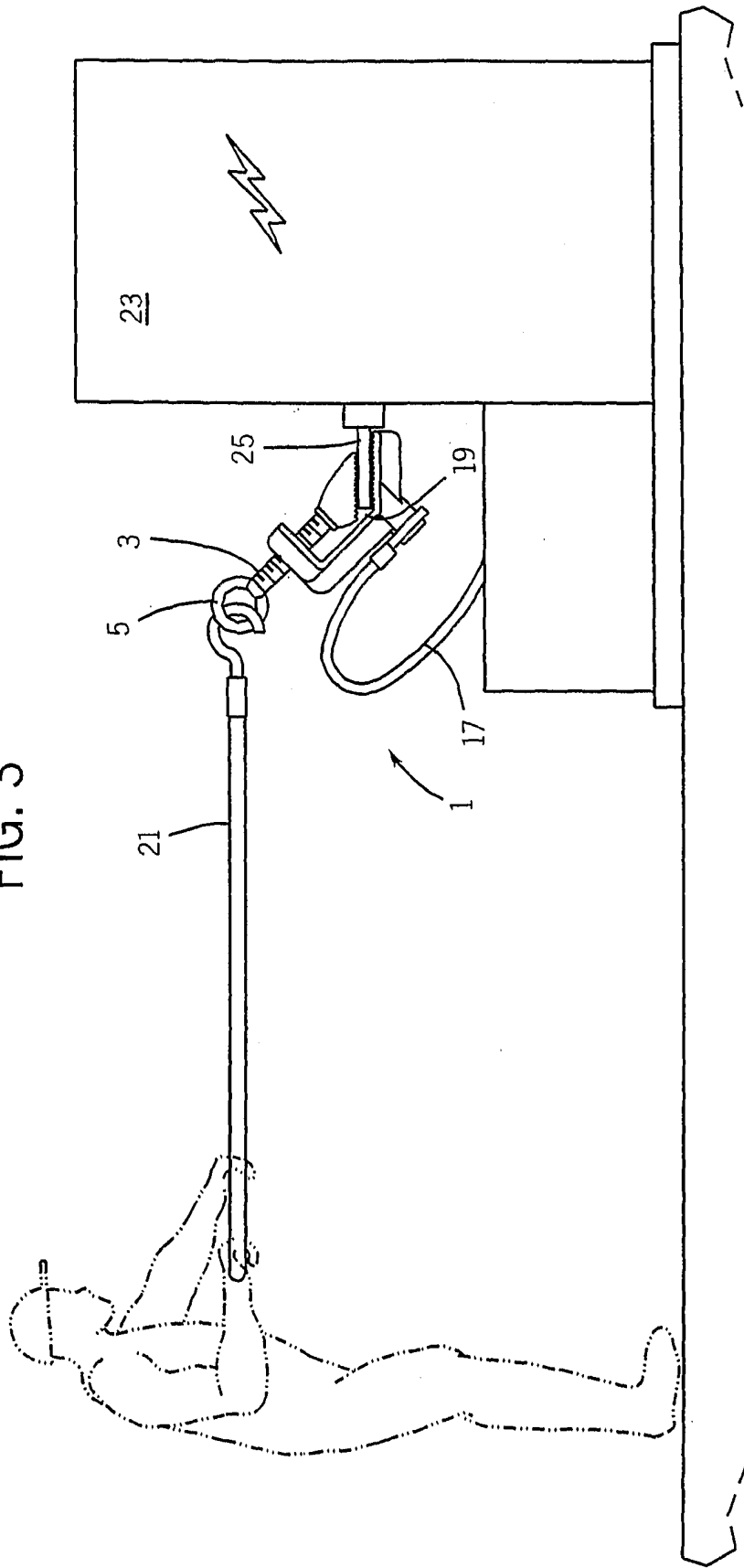


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/000046

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R11/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R H02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1 777 395 A (COON CHESTER C) 7 October 1930 (1930-10-07)	1-3,5,6, 21-29, 32,34-36
Y	page 1, lines 76,81; figures 1-2	4,30,31, 33
Y	----- US 5 046 958 A (BROWN ET AL) 10 September 1991 (1991-09-10) column 3, line 9 - column 6, line 13	4,30,31
Y	----- FR 2 578 107 A (SOCEM) 29 August 1986 (1986-08-29) page 3, line 6 - line 12	33

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2006/000046

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-6, 21-36

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6,21-36

Grounding clamp having two clamping members, the first one being movable relatively to the other, the clamping faces of the clamping members have a particular angle relatively to the axis of the movement of the first clamp in order to insure a good fastening of the clamped part between the clamping members

2. claims: 7-20

Grounding clamp for a potentially energized apparatus using a live-line tool positioned parallel to the gripping surface of the clamp. the problem to be solved is accessing to the clamp.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/000046

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 1777395	A	07-10-1930	NONE	
US 5046958	A	10-09-1991	NONE	
FR 2578107	A	29-08-1986	NONE	