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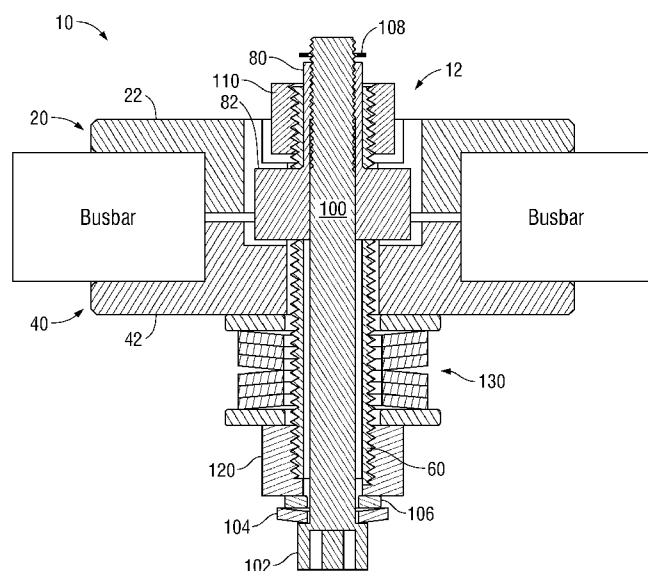


FIG. 1B

(57) Abstract: A busbar clamp includes a first clamp half and a second clamp half that may be fastened together to mechanically and electrically connect a pair of busbars. The first and second clamp halves are initially adjusted using a torque wrench to provide the proper amount of clamping force on the busbars. Thereafter, a non-torque wrench may be used to tighten a busbar release mechanism to disengage the two clamp halves. Loosening the busbar release mechanism using the non-torque wrench reengages the two clamp halves with the same proper amount of clamping force. This allows the busbar clamp to be preconfigured, then deployed in the field without further need for the torque wrench. Additionally, the busbar clamp is virtually impervious to the effects of mechanical stresses and vibrations, as any loosening of the release mechanism caused by such vibrations actually operates to maintain the proper amount of clamping force.

QUICK RELEASE BUSBAR CLAMP

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FIELD OF THE INVENTION

[0001] The disclosed embodiments relate generally to clamps and, more particularly, to a busbar clamp that may be released and reengaged quickly.

BACKGROUND OF THE INVENTION

[0002] A busbar system typically includes two or more busbars and one or more busbar clamps for connecting two busbars together. A typical busbar clamp has two clamp halves that are fastened together by a nut and bolt to mechanically and electrically connect two busbars together. The bolt and nut may be tightened as needed to provide the proper amount of clamping force on the busbars, which is a predetermined amount of clamping force that results in sufficient, but not excessive, contact pressure on the busbars. As those having ordinary skill in the art understand, too little contact pressure may result in a busbar inadvertently being pulled free of the clamp, while too much contact pressure may result in deformation due to the clamped portion of the busbar being unable to expand under high temperature. Torque wrenches are commonly used to provide the proper amount of clamping force.

[0003] A drawback of the above arrangement is torque wrenches require additional space around the busbar clamp as compared to a standard, non-torque wrench. Also, torque wrenches are more expensive and easier to damage than non-torque wrenches and must be used with care. But even when the proper amount of clamping force is applied, nuts and bolts may still work themselves loose over time due to mechanical stresses and vibrations. Regular preventive maintenance is needed to retighten the busbar clamp to avoid compromising the busbar connection. Using a torque wrench to tighten and retightened the clamp to the proper amount of clamping force makes the maintenance process more difficult, tedious, and time consuming.

[0004] Thus, a need exists for an improved busbar clamp that is more able to withstand mechanical stresses and vibrations than existing busbar clamps, and that may be disengaged and reengaged with the proper amount of clamping force using only a

standard (non-torque) wrench. The present disclosure is directed to satisfying one or more of these needs and solving other problems.

SUMMARY OF THE INVENTION

[0005] The disclosed embodiments are directed to a busbar clamping apparatus, and method therefor, that is more able to withstand mechanical stresses and vibrations than existing busbar clamps. The disclosed busbar clamping apparatus may be disengaged and reengaged with the precise amount of clamping force using a standard, non-torque wrench. In general, the busbar clamping apparatus employs a busbar clamp having a first clamp half and a second clamp half that may be fastened together to mechanically and electrically connect a pair of busbars. The first and second clamp halves are initially configured to provide the proper amount of clamping force on the busbars, typically using a torque wrench. Thereafter, a busbar release mechanism allows the two clamp halves to be quickly disengaged and reengaged with the same amount of clamping force using a standard wrench. This busbar release mechanism makes the busbar clamp simple to deploy in the field without further need for the torque wrench. In addition, the busbar release mechanism is configured so that it disengages the clamp halves when tightened and reengages them when loosened. This reversed tightening-loosening convention renders the busbar clamp virtually impervious to the effects of mechanical stresses and vibrations, as any loosening caused by such vibrations actually helps maintain the proper amount of clamping force.

[0006] In some embodiments, the busbar release mechanism includes a hollow cylindrical core passing substantially perpendicularly through each of the two clamp halves. A nut or similar fastening member on each end of the cylindrical core helps retain the two clamp halves on the cylindrical core. One or both of the fastening members may be tightened on the cylindrical core to adjust the amount of clamping force applied by the first and second clamp halves. A spring or other biasing assembly disposed coaxially around the cylindrical core between one of the clamp halves and respective fastening members helps urge that clamp half toward the other clamp half. The biasing assembly ensures the two clamp halves, once they are set with the proper amount of clamping force, steadily exert the correct contact pressure on the busbars while allowing for thermal expansion of the busbar as needed.

[0007] In some embodiments, the busbar release mechanism further includes a plunger inserted within the hollow cylindrical core. The plunger is dimensioned so that it may move coaxially inside the cylindrical core. A plurality of blade-like protrusions extend lengthwise along the plunger and protruding radially outward from the plunger to a distance beyond the cylindrical core through slots formed lengthwise along a portion of the cylindrical core. Corresponding slots formed in one of the clamp halves, the one opposite the biasing assembly, allow the protrusions to move freely as the plunger slides coaxially within the cylindrical core. Internal threads allow the plunger to be mounted onto a drive member, such as a bolt, extending into the cylindrical core up to the bolt head.

[0008] In general operation, the first and second clamps halves may be preset to apply the proper amount of clamping force by tightening either or both of the fastening members of the busbar release mechanism, typically with a torque wrench. Thereafter, the first and second clamps halves may be disengaged and reengaged simply by turning the drive member accordingly, which may be done with a standard wrench. Turning the drive member in the tightening direction moves the plunger toward the second clamp, causing the protrusions to drive the second clamp half away from the busbars and into the biasing assembly. As the drive member is tightened more, the protrusions drive the clamp half further into the biasing assembly, compressing the biasing assembly and easing the pressure exerted by the biasing assembly, thus disengaging the first and second clamps halves from the busbars. Turning the drive member in the loosening direction causes the plunger to travel in the opposite direction, releasing the biasing assembly and restoring the pressure exerted thereby to reengage the busbars at the same contact pressure as before.

[0009] In general, in one aspect, the disclosed embodiments are directed to a busbar clamp comprising a first clamp half having an opening and a passage therethrough contiguous with the opening and a second clamp half having an opening and a passage therethrough contiguous with the opening. The busbar clamp further comprises a cylindrical core extending through the passages in the first and second clamp halves, the cylindrical core having first and second fastening members mounted thereon near the ends thereof, the first and second fastening members securing the first and second clamp halves, respectively, on the cylindrical core. A biasing assembly is disposed coaxially

around the cylindrical core between the second clamp half and the second the fastening member, the biasing assembly configured to urge the second clamp half toward the first clamp half so as to provide a proper amount of clamping force. A plunger is inserted within the cylindrical core, the plunger being dimensioned to freely slide coaxially inside the cylindrical core and having a plurality of protrusions protruding radially outward to a distance beyond the cylindrical core. Finally, a drive member extends through the cylindrical core, the drive member having a threaded shaft and being engaged with the plunger such that rotating the drive member causes the plunger and the protrusions to move along the threaded shaft. Rotating the drive member in a tightening direction moves the plunger and the protrusions along the threaded shaft so as to drive the second clamp half into the biasing assembly and thereby remove the proper amount of clamping force.

[0010] In general, in another aspect, the disclosed embodiments are directed to a busbar system comprising a first busbar configured to carry electrical current and a second busbar configured to carry electrical current. The busbar system additionally comprises a busbar clamp positioned between the first and second busbars, the busbar clamp configured to clamp the first busbar and the second busbar with a proper amount of clamping force to mechanically and electrically connect the first busbar to the second busbar. The busbar system further comprises busbar release mechanism in the busbar clamp, the busbar release mechanism comprising a plunger therein and configured so that tightening the busbar release mechanism causes the plunger to disengage the busbar clamp.

[0011] In general, in yet another aspect, the disclosed embodiments are directed to a method of mechanically and electrically connecting busbars. The method comprises providing a busbar clamp and clamping first and second busbars in the busbar clamp. The method further comprises using a torque wrench to adjust the busbar clamp that so the first and second busbars are clamped with a proper amount of clamping force and using a non-torque wrench to operate a busbar release mechanism in the busbar clamp. The busbar release mechanism comprises a plunger therein and configured so that tightening the busbar release mechanism causes the plunger to disengage the busbar clamp and loosening the busbar release mechanism causes the plunger to reengage the busbar clamp with the same proper amount of clamping force.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The foregoing and other advantages of the disclosed embodiments will become apparent upon reading the following detailed description and upon reference to the drawings, wherein:

[0013] FIGS. 1A and 1B illustrate perspective and cross-sectional views of a busbar clamp according to some implementations of the disclosed embodiments;

[0014] FIGS. 2, 2A, and 2B illustrate a plan view and cross-sectional views of a first clamp half according to some implementations of the disclosed embodiments;

[0015] FIGS. 3, 3A, and 3B illustrate a plan view and cross-sectional views of a second clamp half according to some implementations of the disclosed embodiments;

[0016] FIGS. 4A and 4B illustrate a plan view and a cross-sectional view of a cylindrical core according to some implementations of the disclosed embodiments;

[0017] FIGS. 5A and 5B illustrate a plan view and a cross-sectional view of a plunger according to some implementations of the disclosed embodiments; and

[0018] FIGS. 6-7 illustrate plan views of alternative plungers according to some implementations of the disclosed embodiments.

DETAILED DESCRIPTION OF THE DISCLOSED EMBODIMENTS

[0019] As an initial matter, it will be appreciated that the development of an actual, real commercial application incorporating aspects of the disclosed embodiments will require many implementation specific decisions to achieve the developer's ultimate goal for the commercial embodiment. Such implementation specific decisions may include, and likely are not limited to, compliance with system related, business related, government related and other constraints, which may vary by specific implementation, location and from time to time. While a developer's efforts might be complex and time consuming in an absolute sense, such efforts would nevertheless be a routine undertaking for those of skill in this art having the benefit of this disclosure.

[0020] It should also be understood that the embodiments disclosed and taught herein are susceptible to numerous and various modifications and alternative forms. Thus, the use of a singular term, such as, but not limited to, "a" and the like, is not intended as limiting of the number of items. Similarly, any relational terms, such as, but not limited

to, “top,” “bottom,” “left,” “right,” “upper,” “lower,” “down,” “up,” “side,” and the like, used in the written description are for clarity in specific reference to the drawings and are not intended to limit the scope of the invention.

[0021] Referring now to FIGS. 1A and 1B, a busbar clamp 10 is shown in perspective view and cross-sectional view, respectively, according to the disclosed embodiments. The disclosed busbar clamp 10 may be used in any application that requires electrically and mechanically clamping two busbars together with the proper amount of clamping force without the need for a torque wrench. Applications that may benefit from the use of the disclosed busbar clamp 10 may include electrical switchgear applications, control gear applications, and the like.

[0022] As can be seen, the busbar clamp 10 includes two clamp halves, a first clamp half 20 and a second clamp half 40, that are held together by a busbar release mechanism 12. The busbar release mechanism 12 includes a hollow cylindrical core 60 on which the first and second clamp halves 20, 40 are mounted. The outside of the cylindrical core 60 is threaded to receive similarly threaded fastening members, including a first fastening member 110 and a second fastening member 120, each fastening member located at one end of the cylindrical core 60. In some embodiments, the first fastening member 110 may be adjacent the first clamp half 20 and may be a standard nut 110, and the second fastening member 120 may be adjacent the second clamp half 40 and may be a self-locking nut 120. It is of course possible to reverse the positions of the first and second fastening members 110, 120, depending on the requirements of a particular application, without departing from the scope of the disclosed embodiments. Alternatively, standard nuts 110 may be threaded on both ends of the cylindrical core 60, or self-locking nuts 120 may be threaded on both ends, depending on the requirements of the application.

[0023] A biasing assembly 130, which may be one or more springs disposed within a housing, is mounted on the cylindrical core 60 between one of the clamp halves 20, 40 and a respective fastening member to help urge that clamp half toward the other clamp half. Examples of suitable biasing assemblies may include disc spring assemblies (e.g., Bellville springs), coiled springs assemblies, and the like. In the embodiment shown, the biasing assembly 130 is placed between the second clamp half 40 and the self-locking nut 120. Such a biasing assembly 130 helps provide a constant force that compels the second clamp half 40 toward the first clamp half 20, causing the two clamp halves 20, 40

to steadily exert a predetermined contact pressure on the busbars, yet still allow the busbars to thermally expand as needed.

[0024] The busbar release mechanism 12 also includes a hollow cylindrical plunger 80 provided coaxially within the hollow cylindrical core 60. The cylindrical plunger 80 has an outer diameter that is smaller than an inner diameter of the cylindrical core 60 to allow the plunger 80 to move freely along the length of the cylindrical core 60. A plurality of thin, blade-like protrusions 90a, 90b are provided along the length of the plunger 80 that protrude radially from the plunger 80 to a distance beyond the outer diameter of the cylindrical core 60. The protrusions 90a, 90b may resemble “wings” and, depending on the particular application, may run the entire length of the plunger 80 or less than the entire length of the plunger 80. In the embodiment of FIGS. 1A and 1B, the protrusions 90a, 90b extend from one end of the plunger 80, for example the end adjacent the second clamp half 40, to about a third of the way toward the other end. Alternatively, the protrusions 90a, 90b may occupy some middle portion of the plunger 80, depending on the particular application, without departing from the scope of the disclosed embodiments.

[0025] A plurality of slots (best seen in FIG. 4) are formed along the length of the cylindrical core 60 that allow the protrusions 90a, 90b to move unhindered by the cylindrical core 60. The slots in the cylindrical core 60 are long enough to allow the protrusions 90a, 90b to push the second clamp half 40 far enough into the biasing assembly 130 to disengage the two clamp halves 20, 40 from the busbars. In some embodiments, the slots in the cylindrical core 60 extend about half of the length of the cylindrical core 60. Corresponding slots are also formed in one or both of the clamp halves 20, 40 to allow the protrusions 90a, 90b to move freely within one or both of the clamp halves 20, 40 as the plunger 80 slides coaxially within the cylindrical core 60.

[0026] To facilitate moving the plunger 80 within the cylindrical core 60, the busbar release mechanism 12 further includes a drive member 100, which may be a bolt, that extends into the cylindrical core 60 and the plunger 80. Internal threads are provided in the plunger 80 to allow it to be screwed onto the bolt 100 such that turning the bolt 100 causes the plunger 80 to move along the bolt 100. In the embodiment of FIGS. 1A and 1B, the bolt 100 is inserted into the cylindrical core 60 from the side of the second clamp half 40 so that the head 102 of the bolt 100 is adjacent the second fastening member 120.

A retaining member 108, such as an e-clip, may be provided on the bolt 100 to limit how much the bolt 100 may be undone, ensuring that the bolt 100 is retained on the busbar clamp 10. A disc spring 104 may be provided between the head 102 of the bolt 100 and the self-locking nut 120 to ensure that the bolt 100 has a minimum amount of tension in order to absorb any mechanical vibrations. If needed, a standard disk washer 106 may be disposed between the disc spring 104 and the self-locking nut 120 to help ensure a flush fit in case the self-locking nut 120 has a shape that does not allow the disc spring 104 to make good contact with the periphery of the self-locking nut 120.

[0027] FIG. 2 illustrates a plan view of the first clamp half 20 according to the embodiments disclosed herein, while FIGS. 2A and 2B illustrate cross-sectional views of the first clamp half 20 along lines A-A and B-B, respectively. Such a clamp half may be made of any suitable electrically conductive material, such as copper, aluminum, steel, and the like, including various alloys thereof. The dimensions and shape of the first clamp half 20 may be any that are commonly used in the busbar clamp 10 art, as the specific dimensions and shapes are not particularly important to the practice of the invention.

[0028] As can be seen from the figures, the first clamp half 20 includes a generally rectangular plate-like flange portion 22 and a generally cylindrical cup-like body portion 24 connected perpendicularly thereto. The body portion 24 forms the main structure from which clamping force is generated, while the flange portion 22 functions to convey the clamping force onto the busbars through a clamping surface 23 contiguous with the body portion 24. The clamping surface 23 physically contacts the busbars and is generally flat in the embodiment shown here, but may be curved and/or generally flat with a curved portion in other embodiments to accommodate the surface of the particular busbars being clamped.

[0029] An open borehole or passage 26 extends coaxially through the body portion 24 for receiving the cylindrical core 60. The borehole or passage 26 opens up to and is coextensive with an opening or recessed area 28 design to receive the first fastening member 110, which may be a nut. The shape of the recessed area 28 is preferably hexagonal or nut-shaped so as to prevent the first retainer member from rotating once it is seated within the recessed area 28. An annular seat 27 is formed within the recessed

area 28 for seating the first fastening member 110 within the recessed area 28, thereby securing the first clamp half 20 to the second clamp half 40.

[0030] In accordance with the disclosed embodiments, a plurality of slots 30a, 30b may be formed lengthwise in the body portion 24 of the first clamp half 20 for receiving the protrusions 90a, 90b protruding from the plunger 80. The slots 30a, 30b, which may be seen in FIGS. 2 and 2A, but are not visible in FIG. 2B because line B-B does not cut across the slots 30a, 30b, run through the body portion 24 of the first clamp half 20 and across the recessed area 28 thereof. There are two slots 30a, 30b in the embodiment shown here to match the number of protrusions 90a, 90b, but fewer or more slots and protrusions may certainly be used without departing from the scope of the disclosed embodiments. The slots 30a, 30b extend radially outward from the borehole or passage 26 and generally bisect the recessed area 28, spanning a short distance beyond the width of the recessed area 28 in the particular embodiment depicted here. In other embodiments, the slots 30a, 30b may span less than the entire width of the recessed area 28, or they may extend just even with the width of the recessed area 28. In still other embodiments, the slots 30a, 30b may span the width of the body portion 24. These slots 30a, 30b allow the protrusions 90a, 90b extending from the plunger 80 to freely slide through the body portion 24 to drive the second clamp half 40 into the biasing assembly 130 and compress the biasing assembly 130 when the drive member 100 is turned in the appropriate direction (using a standard wrench).

[0031] A plan view of the second clamp half 40 may be seen in FIG. 3, with corresponding cross-sectional views along lines C-D and D-D, respectively, illustrated in FIGS. 3A and 3B. The second clamp half 40 is similar to the first clamp half 20 insofar as it may be made of the same suitable electrically conductive material and may have similar dimensions and shape commonly used in the busbar clamp 10 art. Like the first clamp half 20, the second clamp half 40 also includes a generally rectangular plate-like flange portion 42 and a generally cylindrical cup-like body portion 44 attached perpendicularly thereto. The body portion 44 again forms the main structure from which clamping force is generated, while the flange portion 42 conveys the clamping force onto the busbars through a clamping surface 43 that, although generally flat in the embodiment shown here, may be curved and/or generally flat with a curved portion in other embodiments.

[0032] As with the first clamp half 20, the second clamp half 40 includes an open borehole or passage 46 that extends coaxially through the body portion 44 for receiving the cylindrical core 60. Although strictly optional, in the embodiment shown here, a plurality of slots 50a, 50b are formed in the body portion 44 of the second clamp half 40 for receiving the protrusions 90a, 90b protruding from the plunger 80. There are again two slots 50a, 50b in the embodiment shown here, but fewer or more than two slots may certainly be used without departing from the scope of the disclosed embodiments. The slots 50a, 50b extends radially outward from the borehole or passage 46 into the body portion 44 of the second clamp half 40. Unlike the slots 50a, 50b in the first clamp half 20, the slots 50a, 50b in the second clamp, if any, do not run all the way through the body portion 44 of the second clamp half 40. These slots 50a, 50b, which are visible in FIGS. 3 and 3A, but not in FIG. 3B because line D-D does not cut across the slots 50a, 50b, run only partly through the body portion 44 of the second clamp half 40, thereby leaving a contact area for the protrusions 90a, 90b as the plunger 80 moves through the cylindrical core 60 to drive the second clamp half 40 toward the biasing assembly 130.

[0033] As for the cylindrical core 60, a plan view and a cross-sectional view along line E-E are illustrated in FIGS. 4A and 4B, respectively. The cylindrical core 60 may be a hollow tube made of steel, copper, aluminum, plastic, or similar material. Such a cylindrical core 60 may substantially resemble a pipe section having an open channel 62 extending the length of the cylindrical core 60. The inner diameter of the cylindrical core 60 is designed to be larger than the outer diameter of the plunger 80 to allow the plunger 80 to move freely along the length of the cylindrical core 60. Threads 64 are formed on the outer surface of the cylindrical core 60 for threading the first and second fastening member 120s (see FIGS. 1A and 1B) on the cylindrical core 60.

[0034] In accordance with the disclosed embodiments, the plurality of slots 70a, 70b are formed lengthwise along the cylindrical core 60 for receiving the protrusions 90a, 90b protruding from the plunger 80. There are two slots 70a, 70b shown here to match the number of protrusions 90a, 90b protruding from the plunger 80, but fewer or more slots may also be used without departing from the scope of the disclosed embodiments. The slots 70a, 70b run along the length of the cylindrical core 60 a sufficient distance so that the protrusions 90a, 90b are not obstructed as they drive the second clamp half 40 into the biasing assembly 130 sufficiently to disengage the two clamp halves 20, 40 from

the busbars. In some embodiments, the slots 70a, 70b may run about half of the way along the length of the cylindrical core 60.

[0035] FIGS. 5A and 5B illustrate a plan view and a cross-sectional view of the plunger 80 along line F-F. Like the cylindrical core 60, the plunger 80 may be a hollow tube made of steel, copper, aluminum, plastic, or similar material, and may substantially resemble a pipe section having an open channel 82 that extends the length of the plunger 80. The outer diameter of the plunger 80 is designed to be smaller than the inner diameter of the cylindrical core 60 to allow the plunger 80 to move freely within the cylindrical core 60. Threads 84 are formed on the inner surface of the plunger 80 for threading the plunger 80 on the drive member 100 (see FIGS. 1A and 1B).

[0036] In accordance with the disclosed embodiments, the plurality of thin, blade-like protrusions 90a, 90b resembling “wings” are formed along the length of the plunger 80. The protrusions 90a, 90b protrude radially outward from the plunger 80 to a distance beyond the outer diameter of the cylindrical core 60. These protrusions 90a, 90b contact and drive the second clamp half 40 into the biasing assembly 130 when the drive member 100 is turned in the appropriate direction. Depending on the particular application, the protrusions 90a, 90b may extend the entire length of the plunger 80 or less than the entire length of the plunger 80. In the embodiment shown here, the protrusions 90a, 90b extend from one end of the plunger 80, namely the end adjacent the second clamp half 40, to about a third of the way toward the other end. In other embodiments, the protrusions 90a, 90b may occupy some middle portion of the plunger 80, depending on the particular application.

[0037] FIG. 6 illustrates a plan view of another embodiment where a plunger 140 has three protrusions 142a, 142b, 142c protruding from the plunger 140, while FIG. 7 illustrates a plan view of yet another embodiment where a plunger 150 has three protrusions 152a, 152b, 152c protruding from the plunger 150. A corresponding number of slots may be provided in the cylindrical core, first clamp half, and optionally the second clamp half in these embodiments as needed to accommodate the number of protrusions.

[0038] In general operation, the biasing assembly 130 causes the first and second clamp halves 20, 40 to apply a predetermined amount of clamping force on the busbars while allowing the two clamp halves 20, 40 to move slightly relative to each other, thus

allowing for busbar thermal expansion. To release the busbar clamp 10, the drive member 100 (bolt) is tightened into the plunger 80 using a standard wrench, which forces the protrusions 90a, 90b of the plunger 80 against the second clamp half 40, thereby compressing the biasing assembly 130. Compressing the biasing assembly 130 relieves the pressure between the clamp halves 20, 40 and the busbars. To reengage the busbar clamp 10, the drive member 100 is loosened until the retaining member 108 (e-clip) on the drive member 100 comes into contact with the cylindrical core 60, which prevents further loosening of the drive member. At this point the two clamp halves 20, 40 are fully in contact with the busbars with the designed clamping pressure automatically restored by operation of the biasing assembly 130. This arrangement allows the busbar clamp 10 to be tightened and released with the required clamping pressure being virtually guaranteed without the use of a torque wrench.

[0039] While particular aspects, implementations, and applications of the present disclosure have been illustrated and described, it is to be understood that the present disclosure is not limited to the precise construction and compositions disclosed herein and that various modifications, changes, and variations may be apparent from the foregoing descriptions without departing from the spirit and scope of the disclosed embodiments as defined in the appended claims.

CLAIMS

What is claimed is:

1. A busbar clamp, comprising:

a first clamp half having an opening and a passage therethrough contiguous with the opening;

a second clamp half having an opening and a passage therethrough contiguous with the opening;

a cylindrical core extending through the passages in the first and second clamp halves, the cylindrical core having first and second fastening members mounted thereon near the ends thereof, the first and second fastening members securing the first and second clamp halves, respectively, on the cylindrical core;

a biasing assembly disposed coaxially around the cylindrical core between the second clamp half and the second the fastening member, the biasing assembly configured to urge the second clamp half toward the first clamp half so as to provide a proper amount of clamping force;

a plunger inserted within the cylindrical core, the plunger being dimensioned to freely slide coaxially inside the cylindrical core and having a plurality of protrusions protruding radially outward to a distance beyond the cylindrical core; and

a drive member extending through the cylindrical core, the drive member having a threaded shaft and being engaged with the plunger such that rotating the drive member causes the plunger and the protrusions to move along the threaded shaft;

wherein rotating the drive member in a tightening direction moves the plunger and the protrusions along the threaded shaft so as to drive the second clamp half into the biasing assembly and thereby remove the proper amount of clamping force.

2. The busbar clamp of claim 1, wherein rotating the drive member in a loosening direction moves the plunger and the protrusions along the threaded shaft so as to release the second clamp half and thereby restore the same proper amount of clamping force.

3. The busbar clamp of claim 1, wherein the cylindrical core and the first clamp half each have a plurality of slots formed therein, the plurality of slots being configured to accommodate movement of the protrusions extending from the plunger.

4. The busbar clamp of claim 1, wherein the second clamp half has a plurality of slots formed therein, the plurality of slots configured to accommodate movement of the protrusions extending from the plunger.
5. The busbar clamp of claim 1, wherein the plurality of protrusions extending from the plunger resemble blades.
6. The busbar clamp of claim 1, wherein the biasing assembly is a disc spring assembly.
7. The busbar clamp of claim 1, wherein the first fastening member is a nut and the opening in the first clamp half is dimensioned to receive the nut and prevent rotation thereof.
8. The busbar clamp of claim 1, wherein the drive member is fitted with a retaining member to retain the drive member in the busbar clamp.
9. The busbar clamp of claim 1, wherein the first clamp half and the second clamp half are preconfigured to provide the proper amount of clamping force.

10. A busbar system, comprising:
 - a first busbar configured to carry electrical current;
 - a second busbar configured to carry electrical current; and
 - a busbar clamp positioned between the first and second busbars, the busbar clamp configured to clamp the first busbar and the second busbar with a proper amount of clamping force to mechanically and electrically connect the first busbar to the second busbar; and
 - a busbar release mechanism in the busbar clamp, the busbar release mechanism comprising a plunger therein and configured so that tightening the busbar release mechanism causes the plunger to disengage the busbar clamp.
11. The busbar system of claim 10, wherein the busbar release mechanism is configured so that loosening the busbar release mechanism causes the plunger to reengage the busbar clamp with the same proper amount of clamping force.
12. The busbar system of claim 10, wherein the plunger has a plurality of blade-like protrusions thereon protruding radially outward from the plunger, the blade-like protrusions being movable to force the busbar clamp open when the busbar release mechanism is tightened.
13. The busbar system of claim 12, wherein the busbar release mechanism further comprises a cylindrical core and the plunger is slidably disposed within the cylindrical core, the cylindrical core having a plurality of slots for receiving the plurality of blade-like protrusions protruding the plunger.
14. The busbar system of claim 13, wherein the busbar release mechanism further comprises a biasing assembly disposed coaxially around the cylindrical core, the biasing assembly configured to ensure the busbar clamp continuously clamps the first busbar and the second busbar with the proper amount of clamping force when the busbar clamp is engaged.

15. The busbar system of claim 10, wherein the busbar release mechanism is preconfigured to provide the busbar clamp with the proper amount of clamping force.
16. A method of mechanically and electrically connecting busbars, comprising:
providing a busbar clamp;
clamping first and second busbars in the busbar clamp;
using a torque wrench to adjust the busbar clamp so that the first and second busbars are clamped with a proper amount of clamping force; and
using a non-torque wrench to operate a busbar release mechanism in the busbar clamp, the busbar release mechanism comprising a plunger therein and configured so that tightening the busbar release mechanism causes the plunger to disengage the busbar clamp and loosening the busbar release mechanism causes the plunger to reengage the busbar clamp with the same proper amount of clamping force.
17. The method of claim 16, wherein the plunger disengages the busbar clamp by driving a plurality of protrusions protruding radially outward from the plunger to force the busbar clamp open when the busbar release mechanism is tightened.
18. The method of claim 17, wherein the plunger drives the plurality of protrusions by sliding coaxially within a cylindrical core.
19. The method of claim 18, wherein the plurality of protrusions being driven by the plunger compresses a biasing assembly as the protrusions force the busbar clamp open.
20. The method of claim 16, wherein the busbar clamp clamps the first busbar and the second busbar in a manner that allows the first busbar and the second busbar to thermally expand as needed.

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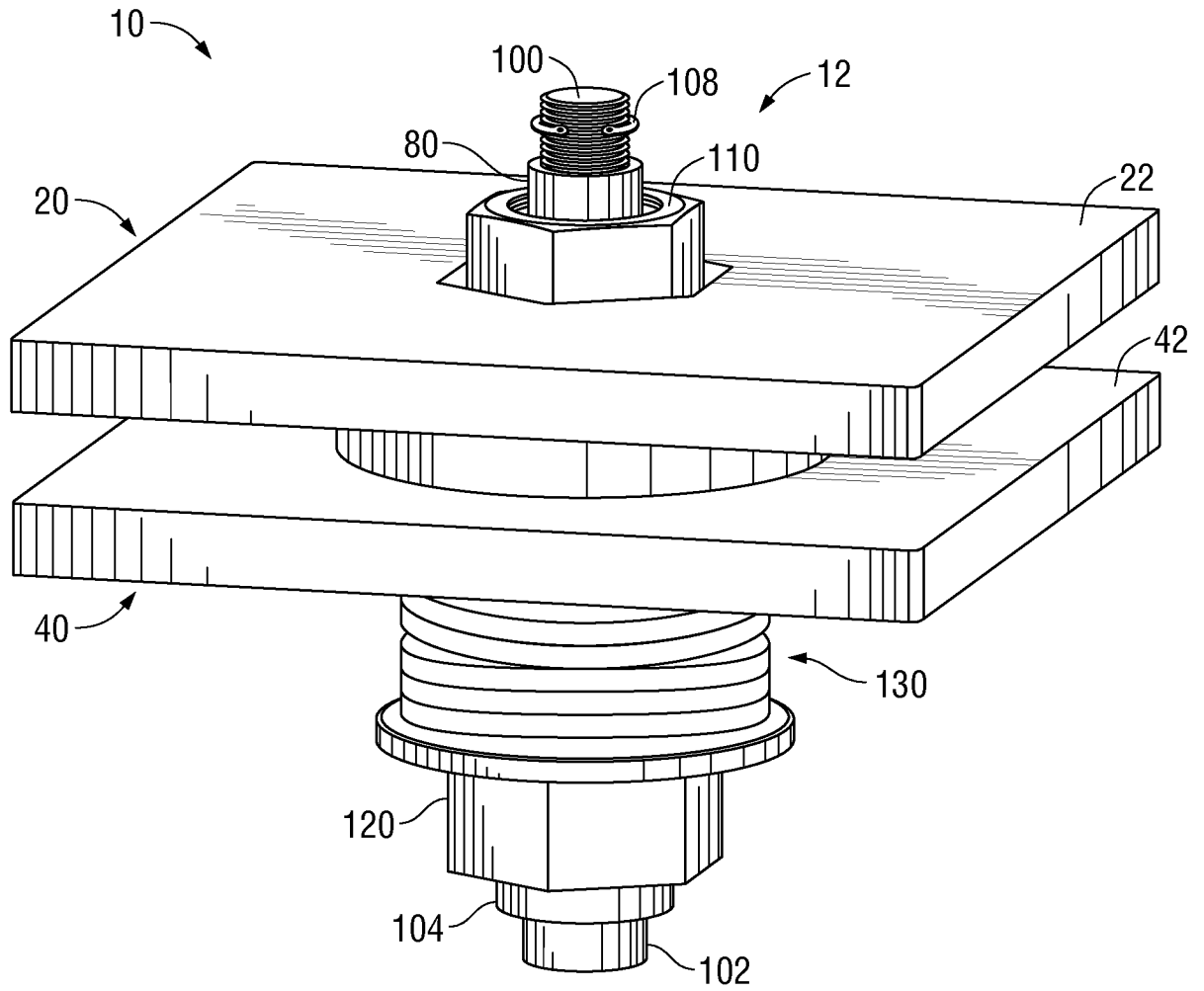


FIG. 1A

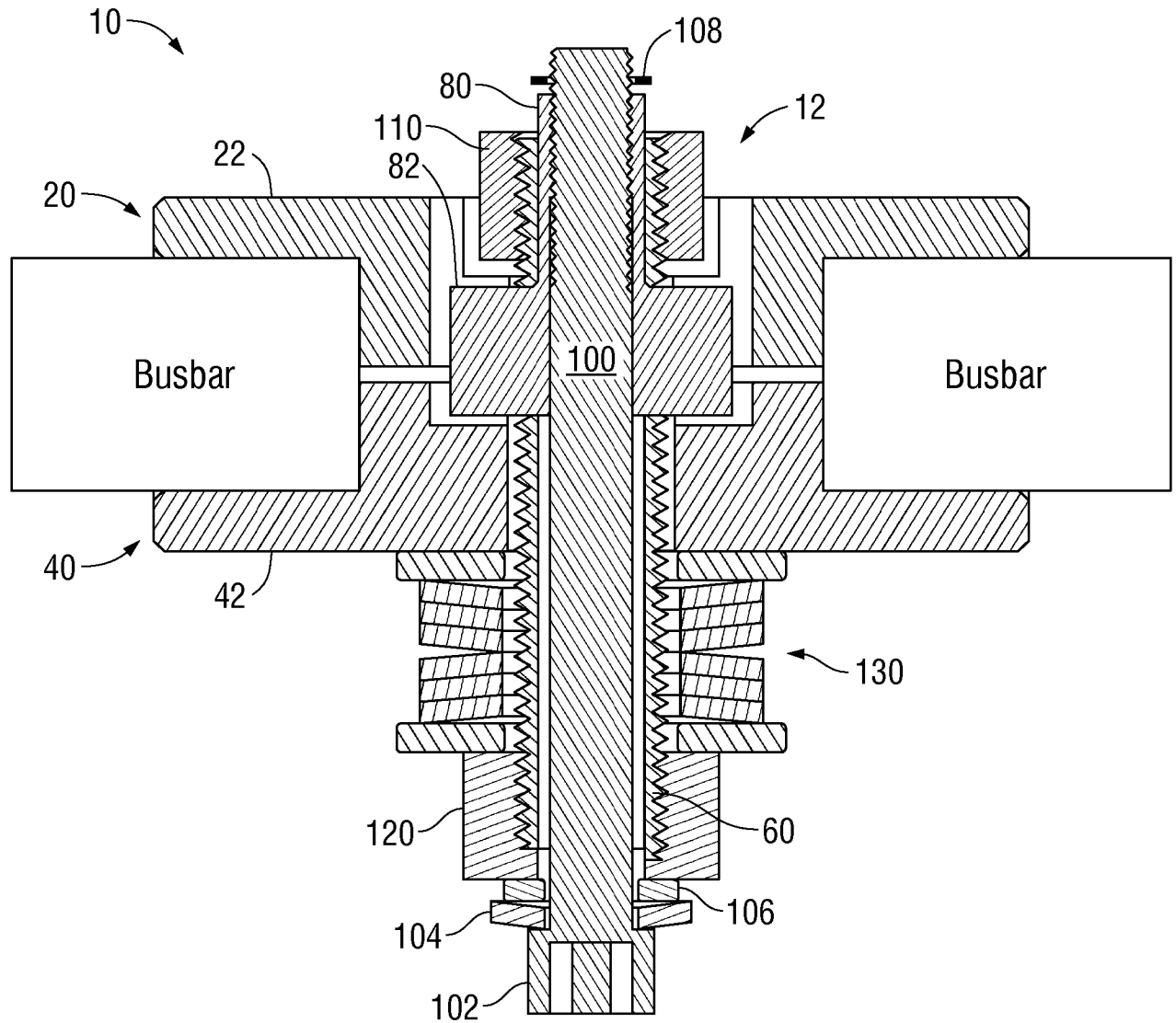


FIG. 1B

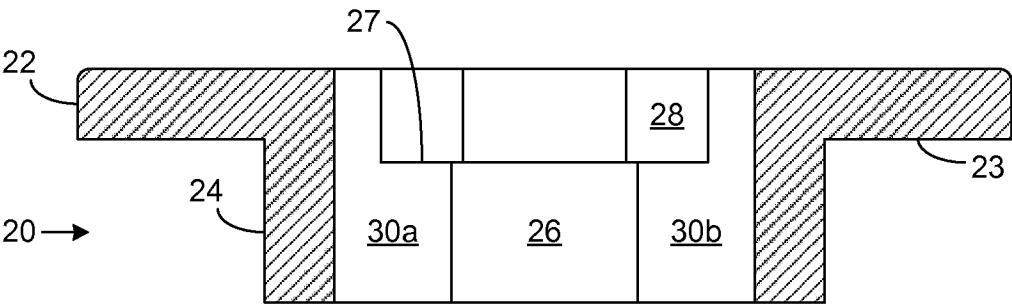


FIG. 2A

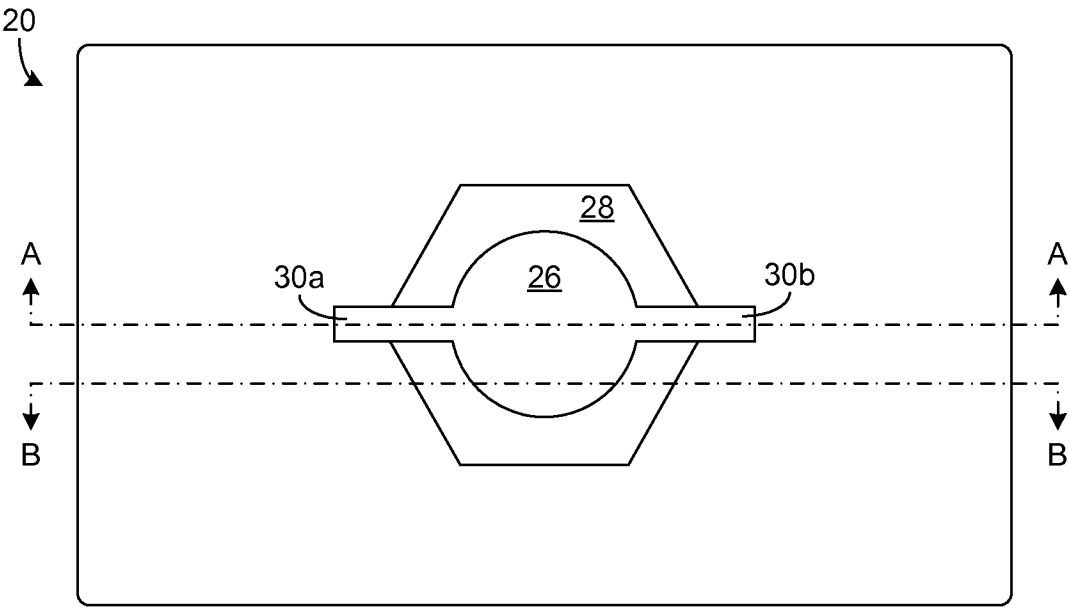


FIG. 2

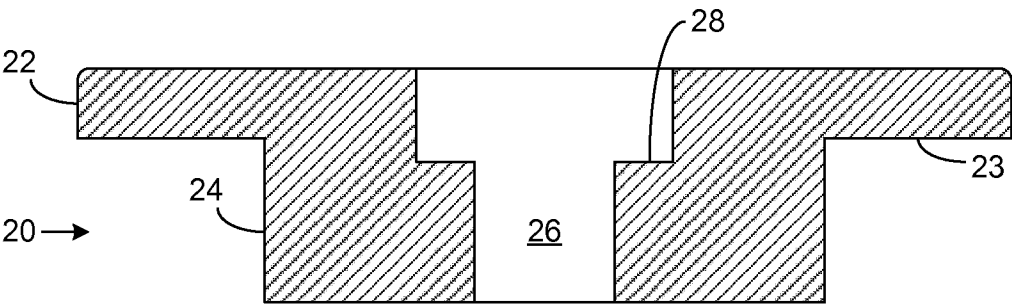


FIG. 2B

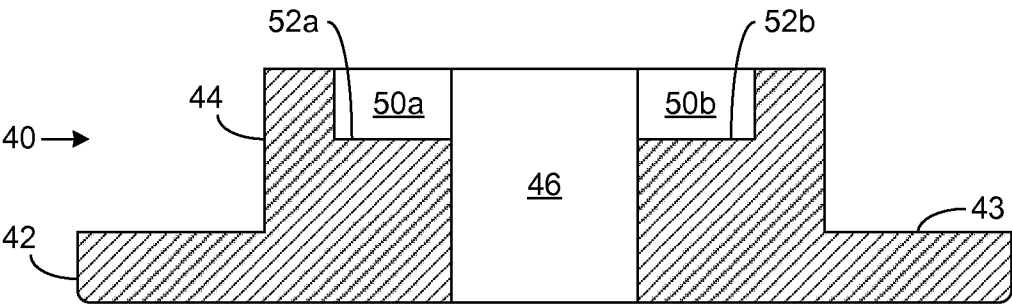


FIG. 3A

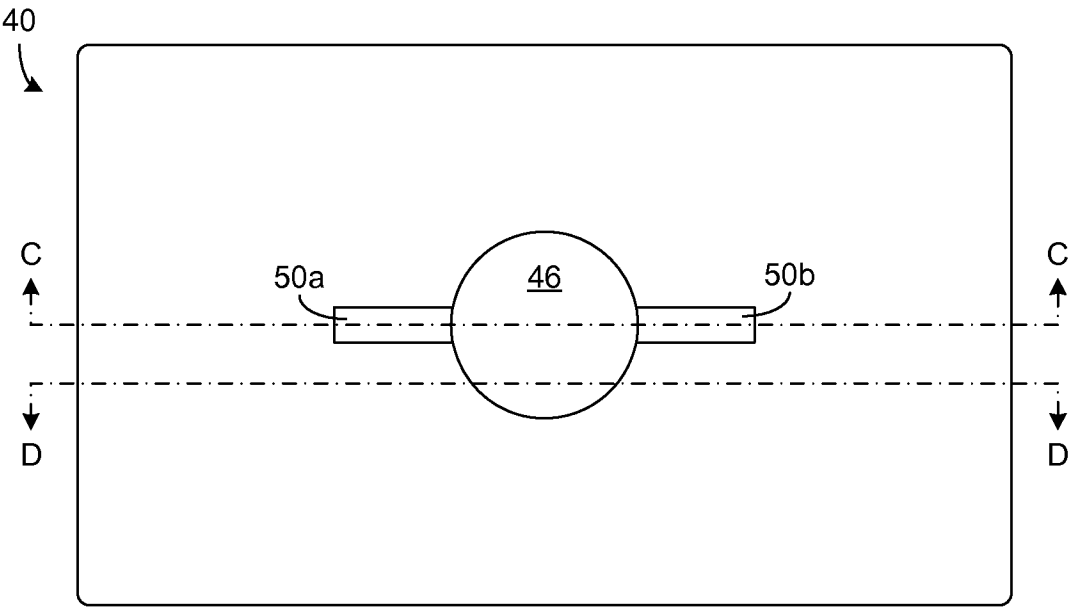


FIG. 3

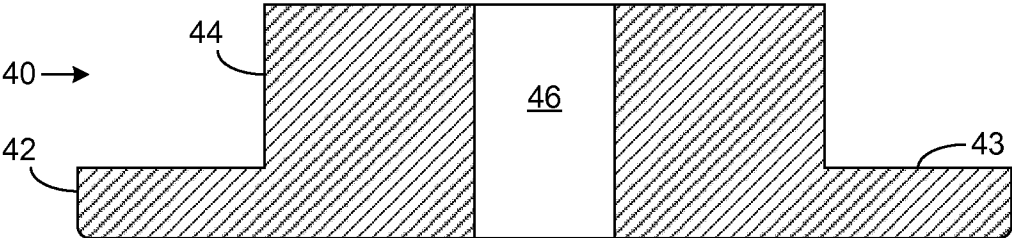


FIG. 3B

FIG. 3

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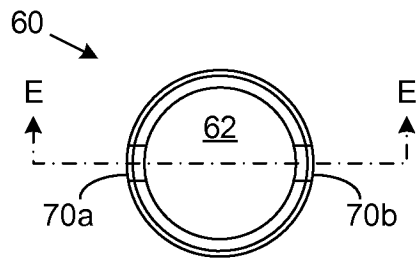


FIG. 4A

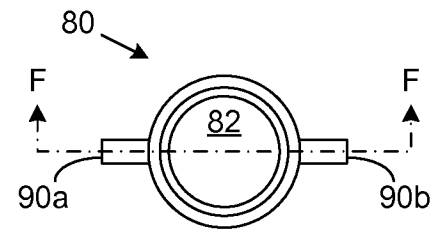


FIG. 5A

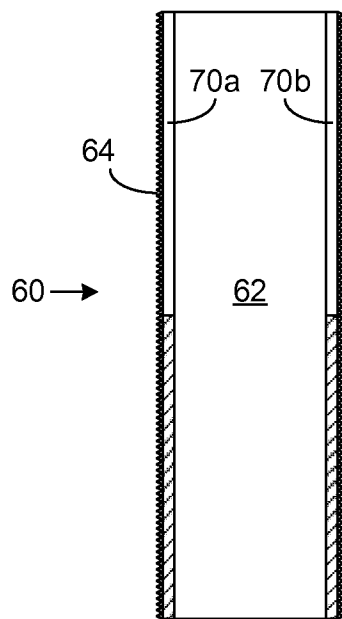


FIG. 4B

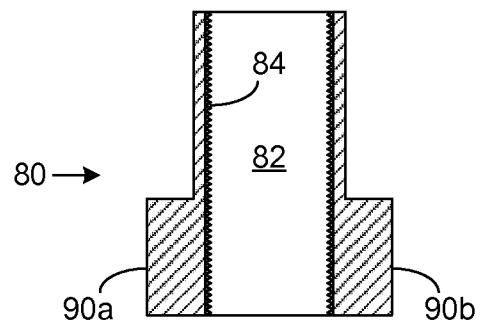


FIG. 5B

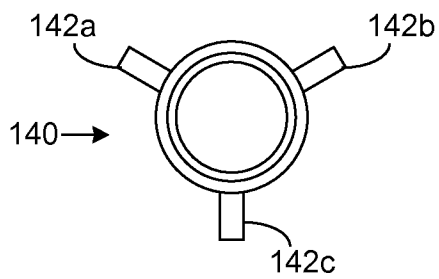


FIG. 6

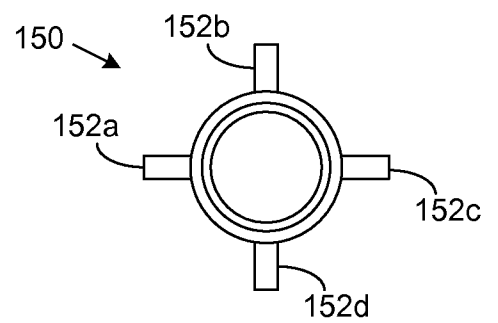


FIG. 7

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H02G 5/00, 5/06 (2014.01)

USPC - 174/68.2; 439/781

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)

IPC(8): H02G 5/00, 5/06; H01R 4/36, 4/48, 13/60; H01H 31/24, 3/26, 3/32 (2014.01)

USPC: 174/68.2; 439/781, 835; 439/115; 218/154; 29/848

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 practicable, search terms used)

MicroPatent (US Granted, US Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); Google; Google Scholar; ProQuest; IEEE; Keywords: Two Busbars, Electrical current, Busbar clamp in between, Clamp connect first and second busbar.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,733,575 A (GOTTSCHALK, F et al.) May 15, 1973; figures 1-6, column 1, lines 1-16; column 1, lines 35- column 2, line 59.	1-20
A	US 5,749,671 A (CHAUQUET, J.) May 12, 1998; figure 8, column 2, lines 24-35; column 2 line 64- column 3, line 21; column 6, line 1-17.	1-20
A	GB 577,845 A (RAWLINSON, J.) June 3, 1946; entire document.	1-20
A	US 5,206,461 (GENZEL, R. et al.) April 27, 1993; entire document.	1-20
A	WO 91/14298 A (HUSKA, P.) September 19, 1991; entire document.	1-20
A	US 4,722,703 A (HUFNAGL, A.) February 2, 1988; entire document.	1-20

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

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"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

03 March 2014 (03.03.2014)

Date of mailing of the international search report

08 APR 2014

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Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
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