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(54) TERMINAL CLAMP WITH SCREW LOCK

(57) A terminal clamp for an electricity meter optimized for a automatized production procedure. The terminal clamp comprising a clamp body comprising a cavity arranged for receiving electrical conductors to be connected and a threaded screw arranged in a matching threaded hole in the clamp body. The screw is arranged to clamp electrical conductors inside the cavity of the clamp body when the screw is screwed into the threaded hole and extends into the clamp cavity. The terminal clamp further comprises a screw locking element, which is arranged to surround the screw in a longitudinal direction and is mechanical fixated relative to the clamp body whereby rotational movement around a longitudinal centre-axis of the screw is prevented. The screw locking element pinch the screw, with the effect of limiting rotational movement of the screw caused by vibrations during the production process.

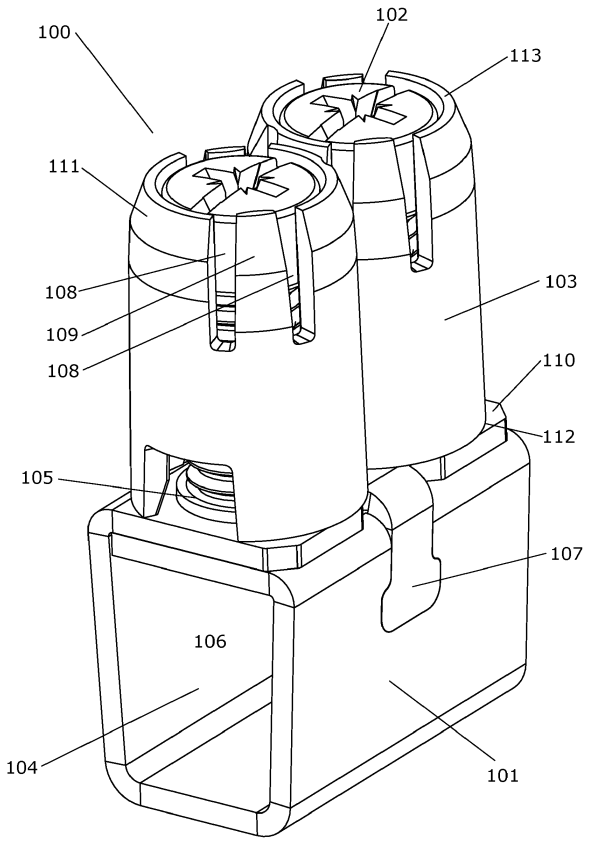

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to terminals for electricity meters, especially screw terminals and terminal clamps optimized for automated production processes of the electricity meter.

BACKGROUND OF THE INVENTION

[0002] The terminals of an electricity meter are essential elements providing key functionality not only during deployment where they serve the purpose of connecting the electricity meter to electricity distribution networks, but also during the production phases where easy access and reliable electrical connection to the terminals is essential to test and verification procedures.

[0003] Automatized production processes using industrial robots and other automatized processes increase the requirements for regularity of the elements to be assembled to ensure a fast and reliable production process with a high level of quality.

[0004] Screw terminals mounted in an electricity meter will during the production process be exposed to vibrations. These vibrations may make the screws of the terminal rotate whereby the terminal clamp may be closed or the screw may disengage from the screw terminal. If the terminal clamp is closed due to vibrations, automated access to the terminals by test equipment is not possible and the automated production procedure will be interrupted.

[0005] Further, vibrations may change the position of the terminals and especially the screws slightly making automated assembly of the electricity meter difficult in an automated production process.

[0006] After the electricity meter has left the production facility it may be subjected to vibrations e.g. during transportation which again may close the terminal clamp. In that case the installer may be required to open the terminals before installation, which will increase the time used for installing the meter.

[0007] Hence, an improved terminal clamp for an electricity meter would be advantageous, in particular a terminal clamp with the property that the mechanical state is insusceptible to vibrations during production and transportation would be advantageous.

OBJECT OF THE INVENTION

[0008] An object of the present invention is to provide an alternative to the prior art.

[0009] In particular, it may be seen as a further object of the present invention to provide a terminal clamp for an electricity meter that solves the above-mentioned problems during an automatized production process and transport of the electricity meter.

SUMMARY OF THE INVENTION

[0010] Thus, the above described object and several other objects are intended to be obtained in a first aspect of the invention by providing a terminal clamp for an electricity meter comprising: a clamp body comprising a cavity arranged for receiving electrical conductors to be connected; and a threaded screw extending in a longitudinal direction and arranged in a matching threaded hole in the clamp body, where the screw is arranged to clamp electrical conductors inside the cavity of the clamp body by screwing the screw into the threaded hole, wherein the terminal clamp further comprises a screw locking element arranged to: surround the screw in the longitudinal direction; be mechanical fixated relative to the clamp body to prevent rotational movement around a longitudinal centre-axis of the screw; and pinch the screw, to limit rotational movement of the screw caused by vibrations. During the production process of an electricity meter a number of terminals are mounted in a casing base of a electricity meter casing. The terminal clamp has the advantage that the screw locking element pinching the screw prevents the screw from rotating during the subsequent production phases of the electricity meter. This is especially of importance in an automated production process where the terminal clamp is subject to vibrations. The screw locking element prevents the screw from being unintentionally screwed into the cavity of the clamp body due to vibrations. Further the screw locking element, if produced form a nonconducting material, has the advantage of increasing electrical isolation between the screws of the terminal clamps in the electricity meter, even when the casing cover of the electricity meter casing is not mounted. Using prior art terminal clamps without this isolation feature require that the isolation is provided by other means, such as extended elements of the meter casing base or meter casing cover. Such extended elements have the disadvantage of increasing complexity of the meter casing and the tools for producing the casing. The terminal clamp of an electricity meter is understood to be the element connecting electric conductors of electricity distribution networks to a measurement circuit of the electricity meter. The distribution networks may be the utility distribution network and a local distribution network of a consumption site. The connection to the distribution network may be directly or indirectly through intermediated conductors e.g. such as pin connectors directly inserted into the terminal clamp. By clamping electrical conductors inside of the cavity body is understood the process of applying a mechanical force to one or more conductors extending into the cavity to create an electrical connection in between the conductors or between the conductors and one or more elements of the terminal clamp, such as the terminal body or screw. The screw extending in a longitudinal direction is to be understood as the length direction of the screw. The screw extents in a longitudinal direction along the a centre-axis of the screw, where the centre-axis of the screw is the axis that

the screw is being rotated around when screwed into the threaded hole. The screw locking element is said to surround the screw in a longitudinal direction, this does not necessarily imply, but may imply, totally or entirely enclosing the screw in a longitudinal direction. A screw locking element with openings or slits along the longitudinal axis is understood to surround the screw in a longitudinal direction. The screw locking element being mechanical fixated relative to the clamp body serve the purpose of preventing the screw from rotating. Fixation of the screw locking element relative to the clamp body does not necessarily mean that the two elements are locked to each other as such, they may be separable, the essential function of the mechanical fixation of the screw locking element relative to the clamp body is to prevent rotational movement of the screw locking element around the centre-axis of the screw. Fixation of the screw locking element relative to the clamp body may be obtained by a direct contact between the two elements or by fixating the elements to a common intermediate member. Dimensions and tolerances of the elements of the terminal clamp and surrounding elements to which they are fixated may give rise to a small and insignificant rotational movement around the centre-axis of the screw which have a limited functional effect as the position of the screw is only changed insignificantly. Prevention of rotational movement around a longitudinal centre-axis of the screw is understood to be obtained even if small rotational movement of +/- 25° or even up to +/- 90° is possible. The screw locking element is arranged to pinch the screw whereby rotational movement of the screw is prevented. Pinching the screw is to be understood as exciting a force to the screw by direct contact between the screw and one or more parts of the screw locking element, with the effect of limiting or preventing the screw from rotating due to vibrations. Pinching of the screw has the effect that when the pinched screw is rotated around its own centre-axis a frictional force between the screw and the screw locking element will arise. Further, as the screw locking element pinch the screw which is partly screwed into the threaded hole of the clamp body the clamp body, the screw and the screw locking element are prevented from disintegrating. The terminal clamp may have only a single screw or alternatively multiple screws arranged for clamping the electrical conductors inside the cavity of the terminal clamp body.

[0011] One embodiment of the terminal clamp above comprises two screws matching two threaded holes in the clamp body, wherein the screw locking element is arranged to surround both of the screws in the longitudinal direction whereby the screw locking element is fixated relative to the clamp body to prevent rotational movement around the centre-axis of the screws. The effect of this embodiment is that the screw locking element by direct mechanical interaction only with the two screws is mechanical fixated relative to the clamp body, which prevents the screws from rotating due to vibrations. This embodiment has the advantage that the terminal clamp as a subassembly is resistant to vibrations in that no intermediate member is used for fixating the screw locking element relative to the clamp body. A further advantage is that screw locking element and clamp body become simpler as no direct connection between the two elements is required.

[0012] In another embodiment of the above terminal clamp the screw locking element comprises a tubular shaped element arranged to surround the screw in the longitudinal direction. In the case of a terminal clamp comprising 2 screws the screw locking element comprises two interconnected tubular shaped elements each arranged to surround one of the two screws. The tubular shape has the advantage of being easy to produce and arrange to pinch the screws without high requirements to the production procedure, especially requirements to the precision of the elements pinching the screw is relieved.

[0013] In an embodiment of the terminal clamp as defined above the screw locking element contains slits to create a resilient part of the screw locking element arranged to pinch the screw. The slits create a finger with an increased resilience, which has the advantage that the forces applied to the screw by pinching becomes less influenced by production tolerances of the screws and the screw locking element. Further the elasticity of the material of the screw locking element becomes less critical, i.e. a stiffer material may be used. The slits may be arranged in the top end of the screw locking element. Especially the slits may be provided in the top end of the tubular shaped element of the screw locking element.

[0014] The terminal clamp of the embodiments above may be arranged such that the screw has a head and the locking element is arranged to pinch only the head of the screw. As the head of the screw typically is the part of the screw having the largest diameter pinching the head only leads to a simpler construction of the screw locking element. Further, the head of the screw is unthreaded having a smooth surface which minimizes the wearing of the screw locking element. Especially the fingers of the screw locking element may be arranged to pinch the head of the screw in that they are provided with protrusions meeting the head of the screw.

[0015] In yet another embodiment of a terminal clamp according to the embodiments above the screw locking element is arranged to not pinch the screw when the screw is in a clamping position and to pinch the screw when the screw is in a non-clamping position. When the screw locking element pinches the screw, the moment needed to rotate the screw is increased. If the screw locking element does not pinch the screw when it is in a clamping position the use of a dynamometric screwdriver to ensure adequate clamping of the electrical conductors will be more accurate.

[0016] In a further embodiment of the terminal clamp according to the preceding embodiments, the screw locking element has a conical shaped inner surface. The inner surface of the screw locking element has a conical shape

with the largest diameter at the bottom end of the screw locking element meeting the clamp body. This has the effect of decreasing required accuracy when mounting the screw locking element on the screw which is advantageous especially for automated production processes. Further the conical inner surface has the effect that pinching is increased as the screw is screwed out of the threaded hole in the clamp body. In the same way an embodiment of the terminal clamp in which the screw locking element further has a conical shaped outer surface has the effect of reducing the precision required when mounting a meter casing cover interfacing the top part of the screw locking element.

[0017] In an embodiment of the terminal clamp the screw locking element has a conical shaped outer surface extending in the longitudinal direction. The conical shaped outer surface has the effect of diminishing the required precision when mounting a cover on top of the terminal clamp which is advantageous in an automatized production line. In another embodiment the terminal the screw locking element has a conical shaped inner surface extending in the longitudinal direction. The conical shaped inner surface has a similar effect of diminishing the required precision when mounting the screw locking element on the screw. The conical shape of the inner and outer surface extending in the longitudinal direction may extent all the way from the bottom end to the top end of the screw locking element. Alternatively, the conical shaped inner or outer surface may extend only in a part of the longitudinal direction such as in the top end or the bottom end. The conical shaped surfaces may have different sections with different slopes of the conical surface.

[0018] A second aspect of the invention provides an electricity meter comprising: a terminal clamp according to any of the abovementioned embodiments for connecting the electricity meter to an electricity distribution network; a measurement circuit; a meter casing arranged to enclose the measurement circuit, where the meter casing comprises: a casing base arranged for receiving the terminal clamp; a casing cover arranged to be mounted on the casing base to close the meter casing, wherein the casing cover has an operating hole for accessing the screw of the terminal clamp and where the operating hole has a conical shape with the largest diameter facing the screw locking element of the terminal clamp. The electricity meter may besides the elements mentioned above comprise additional elements which are common to electricity meters and in particular to smart meters such as: a display; a power supply; a measurement circuit; controller circuit; one or more wired and or wireless communication interfaces supporting radio frequency communication, power line communication or optical communication, near field communication (NFC/RFID), RS232, RS485, USB, interfaces for sub meters; a terminal cover, sealing means etc. The casing base is arranged for receiving multiple elements of the electricity meter, whereas the casing cover is arranged to close the meter casing and shield the elements of the electricity meter as mentioned above from the surroundings. During the production phase the meter may be assembled in multiple steps with the meter casing base as a frame for a sub-assembly meter and as a final step after test and verification of the sub-assembly meter, the meter casing cover is mounted on the meter casing base where after the meter casing is sealed. The Terminal clamp comprising the screw locking element prevents the terminal clamp from closing during the production process due to vibrations. The screw locking element further has the effect of increasing electrical clearance and creepage distance during test and verification procedures performed prior to mounting the casing cover. This has the advantage that sufficient electrical clearance or creepage distances do not need to be provided by other elements such as the casing. When the casing cover is mounted on the casing base the operating hole of the casing cover meet the screw locking element. The conical shape of the screw locking element has the effect of decreasing the required precision of the mounting process which is an advantage in an automatized installation process. The operating hole of the terminal cover is arranged to enable access to the screw of the terminal when the casing cover is mounted on the casing base. The operating hole is a hole with dimensions sufficiently large to allow applying a torque to the screw by use of a screwdriver through the operating hole and small enough to prevent the screw or the head of the screw from extending all the way through the operating hole.

[0019] In one embodiment of the electricity meter as disclosed above the screw locking element extends from the clamp body mounted in the casing base into the conical shaped operating hole of the casing cover mounted on the casing base. The screw locking element is fixated in between the meter casing base and the surface of the clamp body, which may prevent it from disintegrating from the terminal clamp. A further advantage is that the conical shaped holes of the casing cover increases the electrical creepage and clearance distance between the screws of the terminal clamps.

[0020] In another embodiment of the electricity meter the conical shaped operating hole has dimensions allowing the screw locking element to extend into but not all the way through the operating hole. The screw locking element is fixated in between the meter casing base and the surface of the clamp body, which may prevent it from disintegrating from the terminal clamp. Further the conical shapes have the effect of reliving the requirement of the mechanical precision of the individual parts; meter casing base, meter casing cover, terminal clamp body and screw locking element.

[0021] In yet another embodiment of the electricity meter according as disclosed above, the diameter of the conical shaped operating hole has dimensions allowing the head of the screw to extend into but not all the way through the operating hole. This has the effect that a closed compartment is created from which the screw can-

not fall out.

[0022] The first and second aspect of the present invention may each be combined with any of the other aspects. These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE FIGURES

[0023] The terminal clamp according to the invention will now be described in more detail with regard to the accompanying figures. The figures show one way of implementing the present invention and is not to be construed as being limiting to other possible embodiments falling within the scope of the attached claim set.

Figure 1 illustrates the terminal clamp in perspective;

Figure 2a illustrates the terminal clamp mounted in a meter casing with the meter casing cover mounted;

Figure 2b illustrates the terminal clamp mounted in a meter casing with the meter casing cover not mounted, revealing the terminal clamps inside the meter casing; and

Figure 3 illustrates a part of a section A - A of the terminal clamp positioned in the meter casing in between the meter casing base and meter casing cover.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0024] Referring to fig. 1 the terminal clamp 100 is described in detail. The terminal clamp comprises a clamp body 101, two screws 102 and a screw locking element 103. The clamp body has a cavity 106 extending between openings 104 and is arranged to receive one or more electrical conductors in the cavity through the openings 104. One of the electrical conductors may be connected to a metering circuit of an electricity meter while the other electrical conductor may be connected to an electricity distribution network. The screw 102 is mounted in a threaded hole 105 of the clamp body 101 and arranged to extend into the cavity when screwed into the threaded hole 105, whereby conductors inside the clamp body will be clamped. The screw locking element 103 surrounds the screws in a longitudinal direction and is arranged to pinch the screw. As the screw locking element is mechanical fixated relative to the clamp body it will prevent rotation of the screws due to vibrations during production and transportation.

[0025] The clamp body 101 shown in fig. 1 is made from a metal strip which is bent to create the cavity 106 wherein electrical conductors may be clamped together. The clamp body has openings 104 in two ends enabling reception of electrical conductors from two opposite directions. An electrical conductor connected to a measurement circuit of an electricity meter may extend into the cavity of the clamp body from one direction, while an electrical conductor of the electricity distribution network may extend into the cavity from the opposite direction. The holes 105 in the top part of the clamp body 101 are threaded to receive a screw 102. A locking member 107 is cut out in the metal strip and folded to lock the clamp body togetherto prevent the clamp body from opening when electrical conductors are clamped inside the cavity of the clamp body by applying a torque to the screw. This way of creating a clamp is well known in the art. Alternative types of clamps may be used such as barrel clamps or extruded clamps. The clamps are dimensioned to enable reception of electrical conductors such as a cable with a section in the range of 2,5 - 70 mm^2.

[0026] The screws 102 in fig. 1 are arranged to exercise a force directly on the conductors inside the clamp body 101, whereby the conductors are clamped together to create an electrical connection between the conductors or between a conductor and the clamp body 101 and/or the screw 102. As an alternative the clamp may be of an indirect type where the screw102 is arranged to apply a force to an intermediate member inside the cavity of the clamp body (not shown in figures), the intermediate body will then in turn apply a force to the electrical conductors whereby they are clamped. Direct as well as indirect clamping are also well-known within the art. The screws of the terminal clamp may typically be screws in the range M3 to M10 or equivalent.

[0027] The clamp body as well as the screws are preferably made from a metal such as steel, hardened steel, brass the clamp body and the screw may further be Galvanized.

[0028] The screw locking element 103 is arranged to surround the screw 102 in a longitudinal direction and to pinch the screw to prevent vibration induced rotation of the screw. The screw locking element 103 of fig. 1 comprises a tubular shaped element surrounding the screw. For a terminal clamp comprising two screws, the screw locking element comprises two interconnected tubular shaped elements, each surrounding one of the screws. To fulfil the purpose of preventing vibration induced rotation of the screw 102, the screw locking element 103 needs to be mechanical fixated relative to the clamp body 101 to prevent rotation around a centre-axis 114 of the screw 102. The terminal clamp 100 in fig. 1 comprises two screws and the screw locking element is arranged to surround both of the two screws. Thereby rotational movement of the screw locking element around the centre-axis 114 of any of the two screws is prevented. Thus, rotational movement of the screw locking element around the centre-axis 114 of a first screw is prevented by fixating the screw locking element to a second screw which is fixated to or connected to the clamp body. The mechanical fixation of the screw locking element relative to the clamp body may alternatively be provided by fixating the screw locking element directly to the clamp body 101 e. g. by fins or indentations and protrusions on the clamp

body and/or the screw locking element. This may especially be advantageous in case of a terminal clamp with only one screw. Fixating relative to the clamp body may alternatively be provided by fixating the screw locking element to an external device to which the clamp body is also fixated e.g. a meter casing of an electricity meter. Thus, the screw locking element may be fixated directly to the clamp body or to an intermediate element to which the clamp body is directly or indirectly fixated.

[0029] The screw locking element 103 has a bottom end 112 and a top end 113, the bottom end is arranged to rest at the top surface 110 of the clamp body. The top end 113 of the screw locking element pinching around the screw has a conical shaped outer surface 111 with the smallest diameter at the top end 113. The inner surface of the screw locking element also has a conical shape with the largest diameter at the bottom end 112. This shape reduces the required accuracy when mounting the screw locking element on the screw.

[0030] The screw 102 may be in a clamping position or in a non-clamping position. When the screw 102 has been screwed into the threaded hole 105 of the clamp body 101 and the screw extends into the cavity 106 of the clamp body 101 the screw is said to be in the clamping position. When the screw has been screwed out of the threaded hole 105 and only extends slightly into the cavity of the clamp body 101 the screw is said to be in the non-clamping position. The conical shaped inner surface of the screw locking element is arranged only to pinch the screw when the screw is in a non-clamping position. This feature is obtained by arranging the dimensions of the screw locking element such that it only pinches the screw when it extends into the top end 113 of the screw locking element.

[0031] The screw locking element 103 is provided with slits 108 in the top end 113 to provide resilient fingers 109 arranged to pinch the screw. The slits are arranged in a longitudinal direction of the screw locking element in parallel with a centre-axis of the screw 114. One or more resilient fingers 109 arranged to pinch the screw are provided by arranging slits 108 in a longitudinal direction of the screw locking element. The screw locking element in fig. 1 has slits 108 arranged in the tubular element which are parallel to the centre-axis 114 of the screw. All or some of the created fingers may pinch the screw. The fingers are arranged in pairs of two to pinch the screw from opposite directions or alternatively an even or uneven number of fingers are created to pinch the screw from different directions. As an alternative to creating resilient fingers 109 the entire or major part of the inner circumference of the screw locking element may pinch the screw and resilience may be provided by the material of the screw locking element. Providing protrusions on the top end of the fingers of the screw locking element meeting the screw will increase pinching when the screw is in a non-clamping position.

[0032] The screw 102 has a head and a threaded part. The dimensions of the head may be larger than the dimensions of the threaded part. The screw locking element may be arranged to pinch only the head of the screw. The fingers may be provided with protrusions meeting the screw or the head of the screw. As an alternative the entire or major part of the inner circumference of the screw locking element may pinch the head of the screw. Protrusions on the fingers may be arranged in the top end 113 of the screw locking element to pinch the head of the screw when in a non-clamping position. Alternatively, the screw may have no defined head or a threaded head, or the head of the screw has dimensions not differing significantly from the threaded part of the screw. The screw locking element may be arranged to pinch the threaded part of the screw.

[0033] The screw locking element 103 may be made from a metal or a polymer. The polymer may be fibre reinforced to increase temperature stability. The fibre reinforcement may be any suitable type of fibres, e.g. 5-30% glass fibres. Using a polymer for the screw locking element has the advantage that the screw locking element may provide electrical isolation of the screws from the surroundings. The slits 108 in the locking elements may be arranged at a position such to increase the electrical creepage / clearance distance between the screws of two terminal clamps arranged to each other as illustrated in fig. 2b.

[0034] Fig. 2a and 2b illustrates the terminal clamp when installed in an electricity meter casing 400 comprising a casing base 402 and a casing cover 401. In fig. 2a the electricity meter casing 400 is closed with the casing cover 401 mounted whereas the in fig. 2b the meter casing is open without the casing cover 401 mounted on the casing base 402. In fig. 2a the screws 102 of the terminal clamp is visible through an operating hole 403 in the casing cover 401. Electrical conductors to be clamped may be inserted to the terminal clamps through openings 404 in the casing base 402. Fig. 2b show the terminal clamp when mounted in the casing base 402. The terminal clamps are mounted in the casing base close to each other. The terminals are intended to be connected to the power distribution network, consequently an electrical potential difference of several hundreds of Volts will arise. In Europe the potential difference between two phases of the electricity distribution network for end consumers is typically in the range 380-440V. The screw locking element 103, if manufactured in a non-electric conducting material, affects the isolation between the terminals by increasing the electrical creepage / clearance distance between the screws 102 of terminal clamps arranged next to each other. The slits 108 of the screw locking elements are arranged in positions maximising the electrical creepage / clearance distance between the screws 102 of two terminal clamps when the terminal clamps are arranged next to each other with the length direction of the clamp bodies being parallel, as illustrated in fig. 2b. The tubular shaped element of the screw locking element surrounding the screws is arranged concentric with the screw. The screw locking el-

ement has slits 108 in the circumference, to create fingers 109. The slits 108 are arranged in the circumference of the screw locking element in the ranges 0-80° and 100°-260° and 280°-360° relative to a line parallel to the length direction of the terminal body crossing the centre of the screw and 0° and 180° of the circumference of the screw locking element.

[0035] Fig. 3 illustrates a cross section of the terminal clamp 100 arranged in the electricity meter casing 400. The terminal clamp is arranged in a compartment of the casing base 402 and the screw locking element extends into the operating hole 403 of the casing cover 401 which is mounted on the meter casing base. The terminal clamp is mechanical fixated in between meter casing base and the meter casing cover. The screw locking element, resting on the top surface 110 of the clamp body, is kept in position by the casing cover in that the screw locking element 103 extends into the conical shaped operating hole 403 of the casing cover 401. The top end 113 of the screw locking element has a conical shaped outer surface arranged to extent into the conical shaped operating hole 403 of the casing cover 401. The screw is arranged inside a screw compartment created by the screw locking element, the meter casing cover, and the top surface of the clamp body. The dimensions of the operating hole 403 prevents the screw form falling out of the screw compartment. The screw is guided by the screw locking element. The screw locking element is arranged to guide an unscrewed screw into the threaded hole 105 of the clamp body, in that the inner wall of the screw locking element will guide the screw. The screw locking element provides electrical isolation between the screws of terminal clamps arranged next to each other.

[0036] Connection to a measurement circuit of the electricity meter may be provided by an electrical conductor extending into the cavity 106 of the clamp body 101 through the opening 104 of the clamp body facing the opposite direction of the openings 404 in the casing base 402. The terminal clamp is arranged to clamp electrical conductors extending into the cavity of the clamp body from opposite directions through two different openings 104 in the clamp body.

[0037] Although the present invention has been described in connection with the specified embodiments, it should not be construed as being in any way limited to the presented examples. The scope of the present invention is set out by the accompanying claim set. In the context of the claims, the terms "comprising" or "comprises" do not exclude other possible elements or steps. Also, the mentioning of references such as "a" or "an" etc. should not be construed as excluding a plurality. The use of reference signs in the claims with respect to elements indicated in the figures shall also not be construed as limiting the scope of the invention. Furthermore, individual features mentioned in different claims, may possibly be advantageously combined, and the mentioning of these features in different claims does not exclude that a combination of features is not possible and advantageous.

Claims

1. A terminal clamp for an electricity meter comprising:

- a clamp body (101) comprising a cavity (106) arranged for receiving electrical conductors to be connected; and
- a threaded screw (102) extending in a longitudinal direction and arranged in a matching threaded hole (105) in the clamp body, where the screw (102) is arranged to clamp electrical conductors inside the cavity of the clamp body when screwed into the threaded hole,

wherein the terminal clamp further comprises a screw locking element (103) arranged to:

- surround the screw (102) in the longitudinal direction;
- be mechanical fixated relative to the clamp body (101) to prevent rotational movement around a longitudinal centre-axis (114) of the screw; and
- pinch the screw, to limit rotational movement of the screw caused by vibrations.

2. A terminal clamp according to claim 1, comprising two screws (102) matching two threaded holes (105) in the clamp body (101), wherein the screw locking element (103) is arranged to surround both of the screws in the longitudinal direction whereby the screw locking element is fixated relative to the clamp body to prevent rotational movement around a centre-axis (114) of the screws.

3. A terminal clamp according to any of the preceding claims, wherein the screw locking element (101) comprises a tubular shaped element arranged to surround the screw (102) in the longitudinal direction.

4. A terminal clamp according to claim 3, wherein the screw locking element (101) comprises two interconnected tubular shaped elements each arranged to surround one of the two screws (102).

5. A terminal clamp according to claim 1, wherein the screw locking element (103) contains slits (108) to create a resilient part (109) of the screw locking element arranged to pinch the screw (102).

6. A terminal clamp according to any of the preceding claims wherein the screw (102) has a head and the screw locking element (103) is arranged to pinch only the head of the screw.

7. A terminal clamp according to any of the preceding claims, wherein the screw locking element (103) is arranged to not pinch the screw when the screw is in a clamping position and to pinch the screw when the screw is in a non-clamping position.

8. A terminal clamp according to any of the preceding claims, wherein the screw (102) is arranged to clamp the electrical conductors directly by applying a force directly to the electrical conductors inside the cavity (106) of the clamp body (101).

9. A terminal clamp according to any of the preceding claims, wherein the screw (102) is arranged to clamp the electrical conductors indirectly by applying a force to a pressure plate placed inside the cavity (106) of the clamp body (101).

10. A terminal clamp according to any of the preceding claims, wherein the screw locking element (103) has a conical shaped outer surface (111) extending in the longitudinal direction.

11. A terminal clamp according to any of the preceding claims, wherein the screw locking element (103) has a conical shaped inner surface extending in the longitudinal direction.

12. An electricity meter comprising: a terminal clamp according to any of the preceding claims for connecting the electricity meter to an electricity distribution network; a measurement circuit; a meter casing arranged to enclose the measurement circuit, where the meter casing comprises:

    - a casing base (402) arranged for receiving the terminal clamp; and
    - a casing cover (401) arranged to be mounted on the casing base to close the meter casing,

    wherein the casing cover (401) has an operating hole (403) for accessing the screw (102) of the terminal clamp and where the operating hole (403) has a conical shape with a largest diameter facing the screw locking element (103) of the terminal clamp.

13. An electricity meter according to claim 12, where the screw locking element (103) extends from the clamp body (101) mounted in the casing base (402) into the conical shaped operating hole (403) of the casing cover (401) mounted on the casing base (402).

14. An electricity meter according to claim 12-13, where the conical shaped operating hole (403) has dimensions allowing the screw locking element (103) to extend into but not all way through the operating hole (403).

15. An electricity meter according to claim 12-14, where the conical shaped operating hole (403) has dimensions allowing a head of the screw (102) to extend into but not all the way through the operating hole (403).

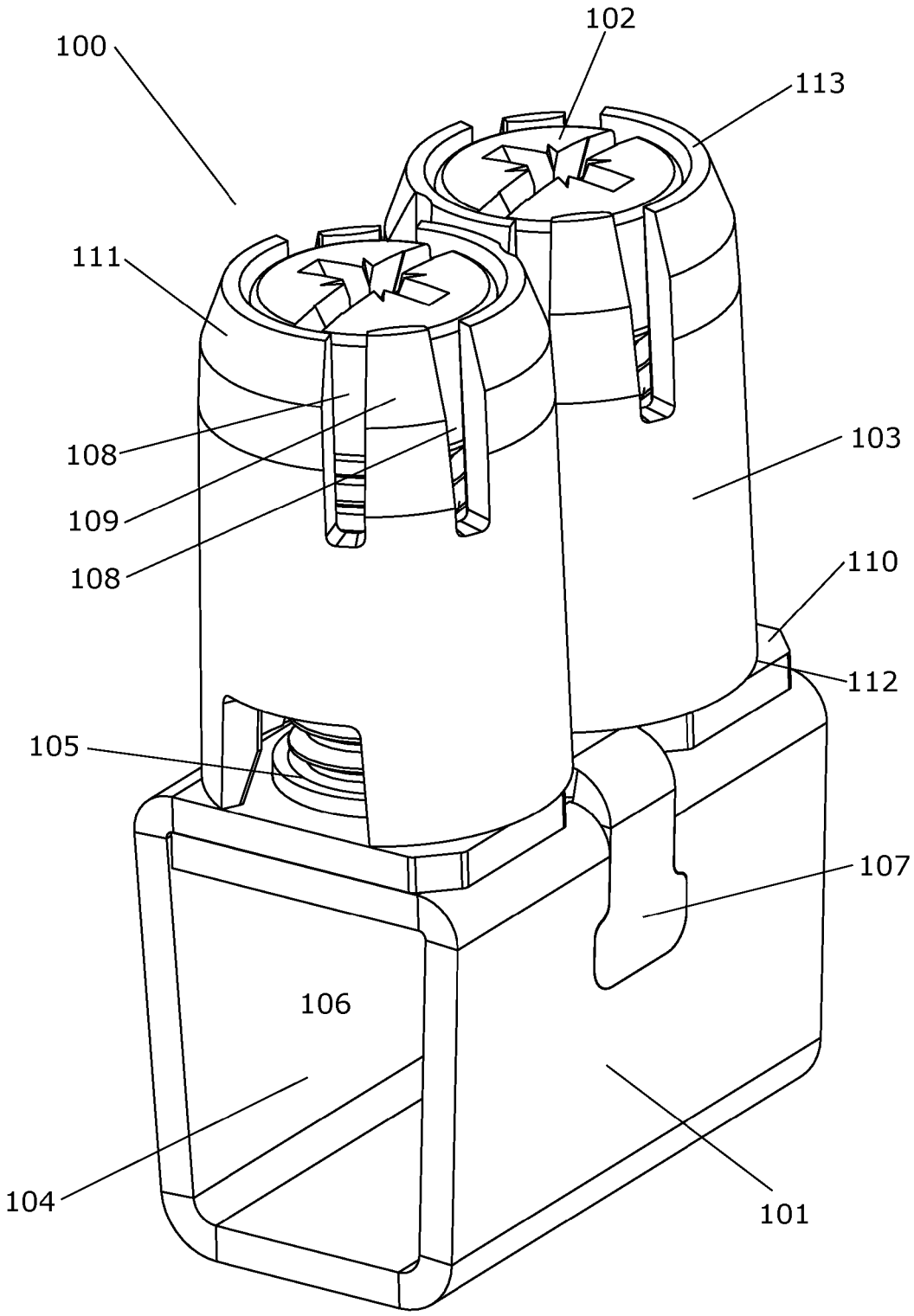

Fig. 1

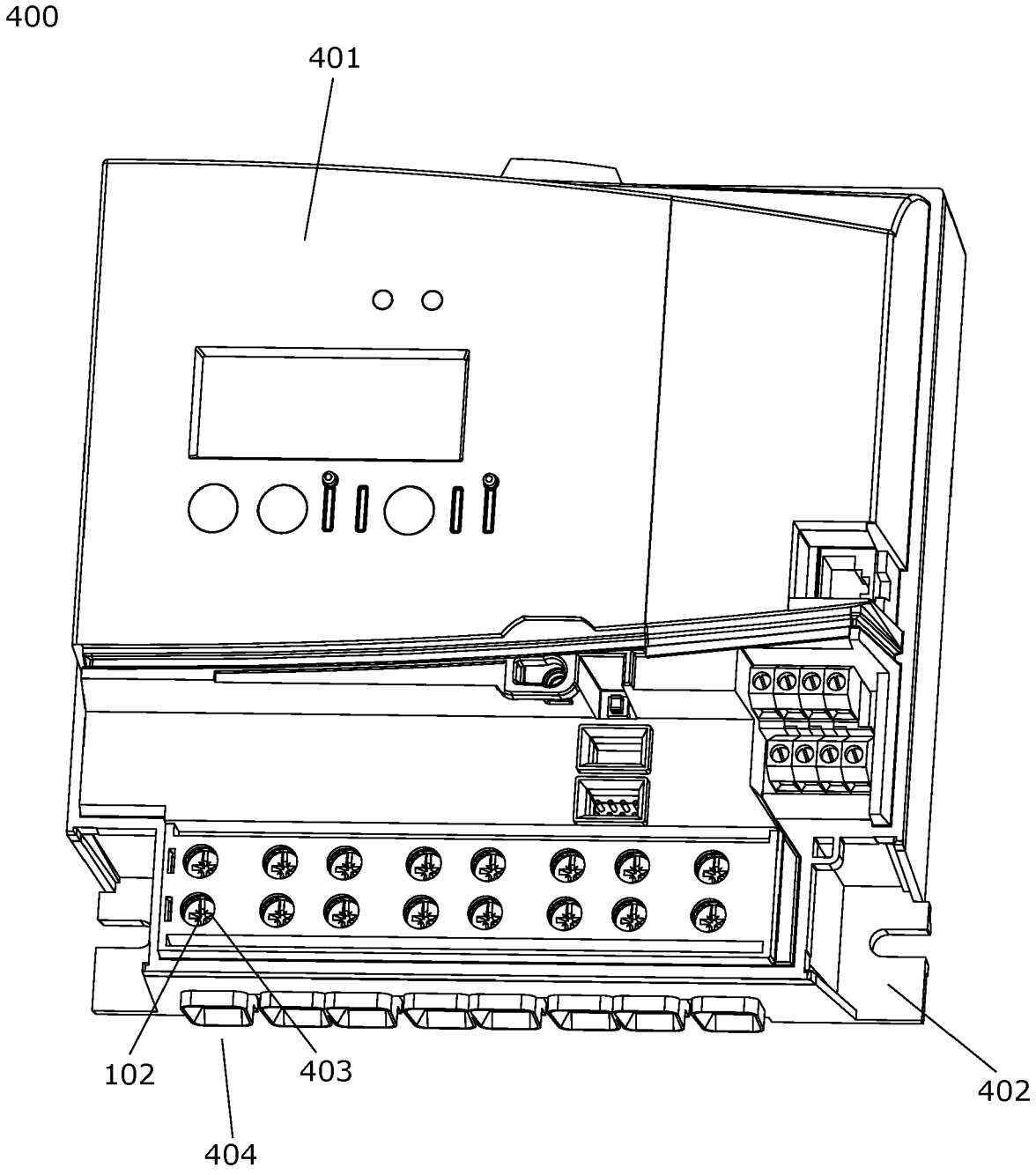

Fig. 2a

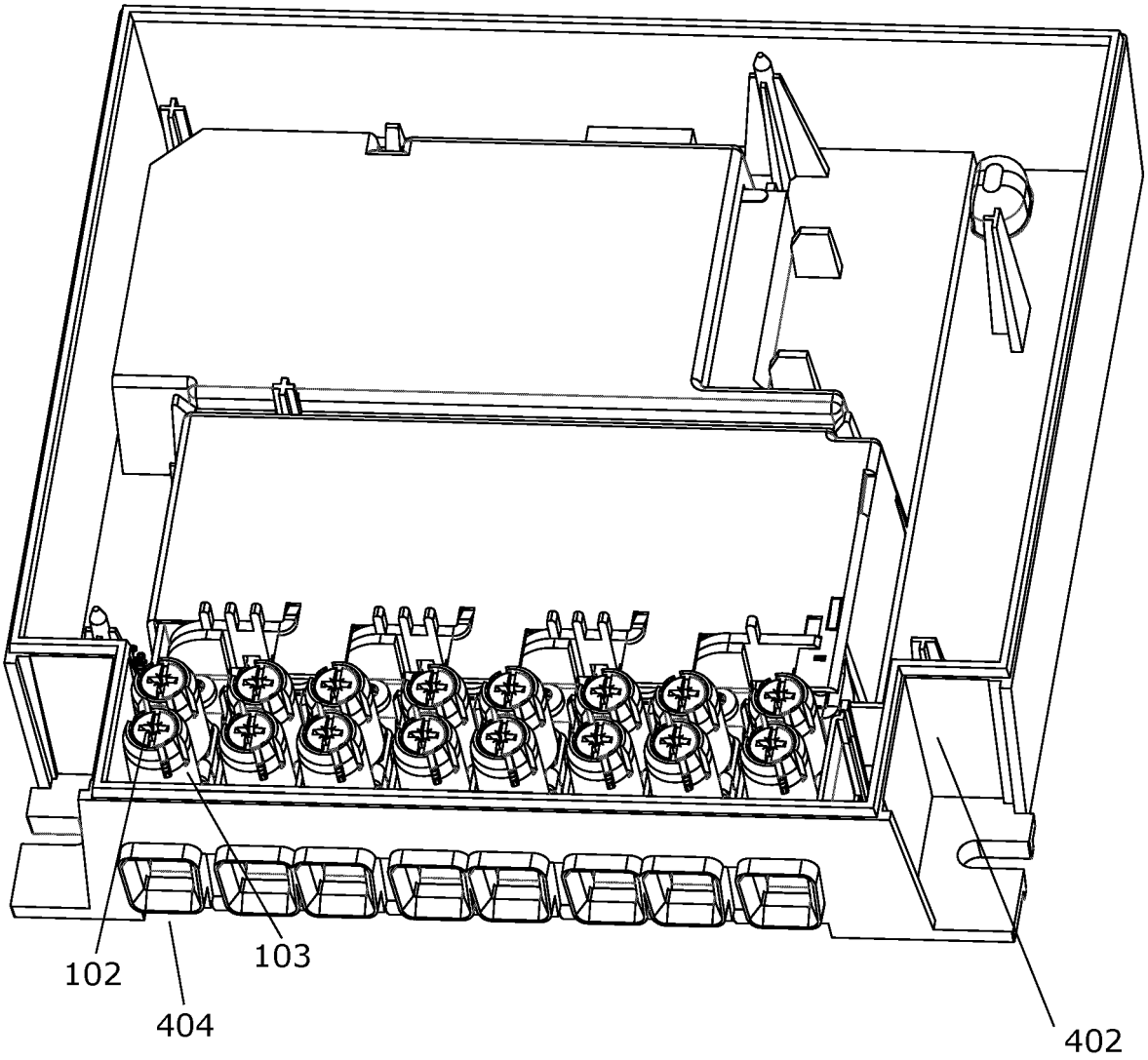

Fig. 2b

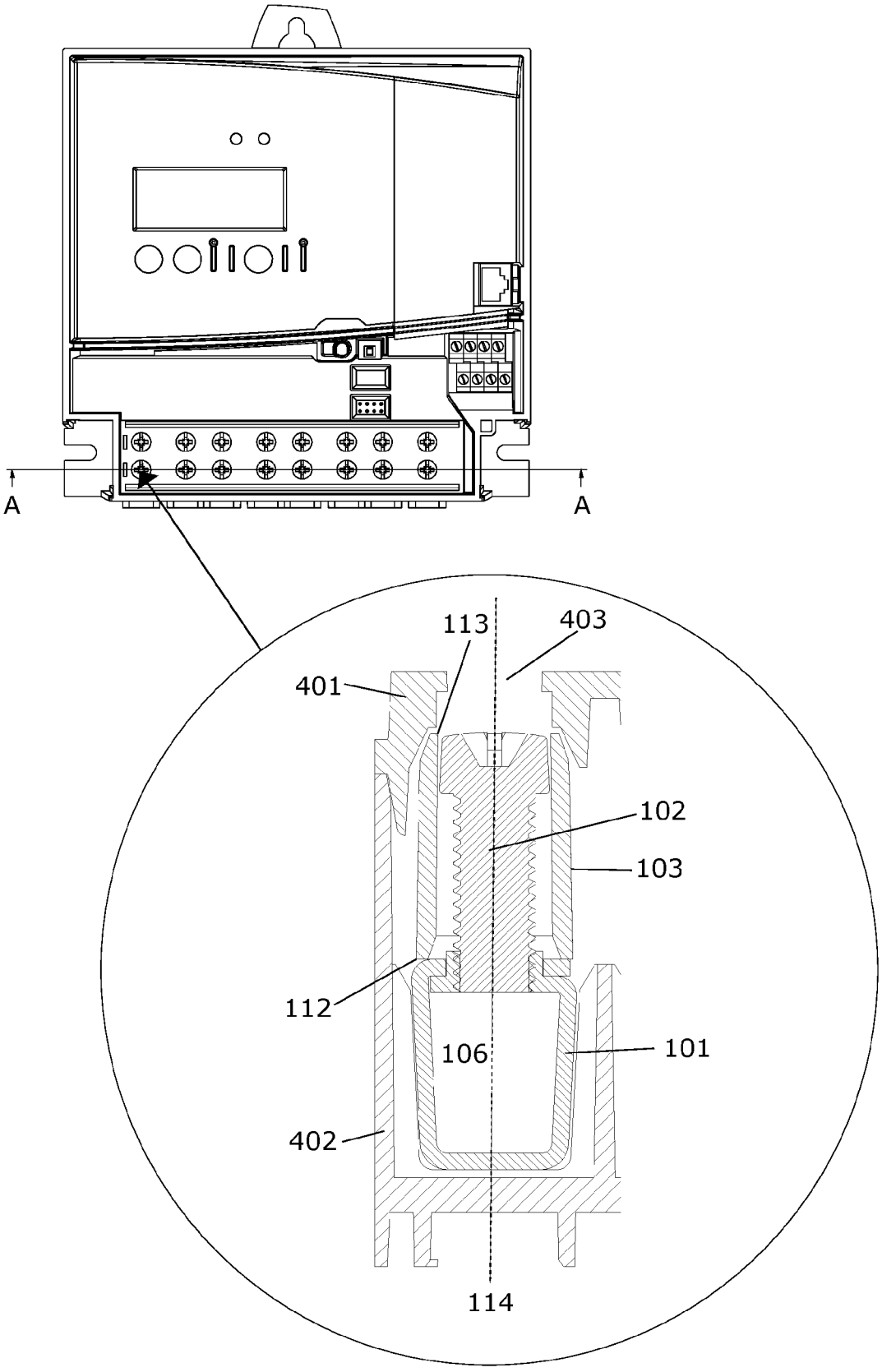

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 3297

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 20 2008 012128 U1 (PHOENIX CONTACT GMBH & CO [DE]) 16 April 2009 (2009-04-16) * figures 1-8 * * paragraphs [0001] - [0042] *	1-4,6-15	INV. H01R4/30 H01R4/36
X	CH 511 522 A (ALFRED GROSSAUER ELEKTROTECHNI [CH]) 15 August 1971 (1971-08-15) * figures 1-3 * * columns 1-3 *	1,3,5, 12-15	
A	WO 2009/068216 A1 (PHOENIX CONTACT GMBH & CO [DE]; FEYE-HOHMANN JUERGEN [DE]) 4 June 2009 (2009-06-04) * figures 1-4 * * pages 1-7 *	1-15	
A	EP 3 051 633 A1 (MORSETTITALIA SPA [IT]) 3 August 2016 (2016-08-03) * figures 1-9 * * paragraphs [0001] - [0028] *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 May 2019	Kandyla, Maria

CATEGORY OF CITED DOCUMENTS

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27-05-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 202008012128 U1	16-04-2009	NONE	
CH 511522 A	15-08-1971	NONE	
WO 2009068216 A1	04-06-2009	CN 101785147 A	21-07-2010
		DE 102007058051 B3	20-08-2009
		EP 2215693 A1	11-08-2010
		JP 5231564 B2	10-07-2013
		JP 2011501069 A	06-01-2011
		US 2010107406 A1	06-05-2010
		WO 2009068216 A1	04-06-2009
EP 3051633 A1	03-08-2016	EP 3051633 A1	03-08-2016
		PL 3051633 T3	30-11-2018
		US 2016218448 A1	28-07-2016

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