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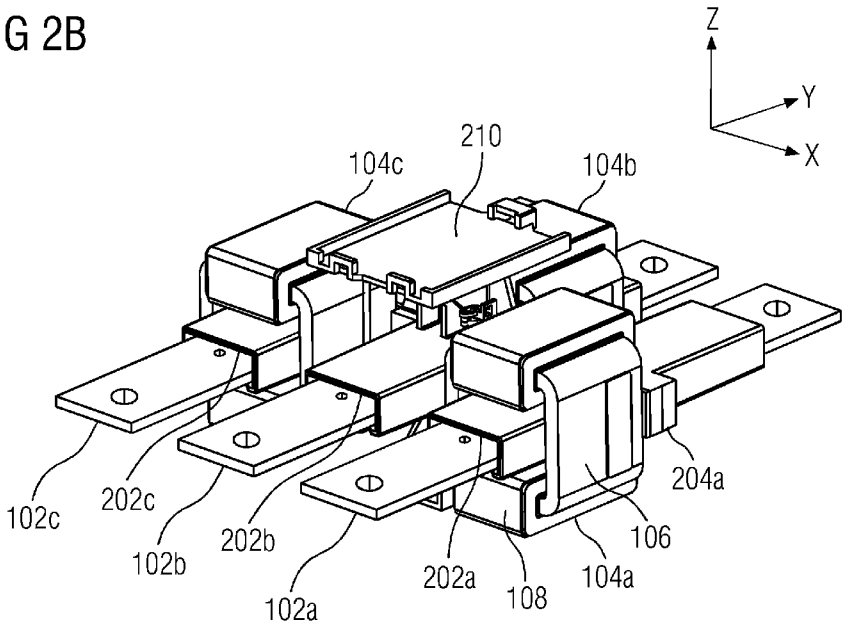
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(54) **Title**: CURRENT TRANSFORMER ASSEMBLY

FIG 2B



(57) **Abstract**: A current transformer assembly is provided. The current transformer assembly includes a carrier frame that supports a busbar sub-assembly and multiple electromagnetic sub-assemblies. The carrier frame is adapted to support the busbars along a longitudinal direction and the electromagnetic sub-assemblies are arranged such that at least a first and a second electromagnetic sub-assembly are arranged in a fixedly spaced relationship along said longitudinal direction.

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Description

Current transformer assembly

The present invention is generally related to a current transformer assembly. More specifically, the present invention is related to a current transformer assembly providing a compact form-factor and adapted for an effective integration with suitable electrical devices.

In electric power systems, electrical switchgear refers to a combination of electrical switches/contactors and electrical protection devices (such as circuit breakers, overload relays, and so on) collectively used to control and protect electrical equipment. Such electrical switchgear is extensively used in electrical power systems; and in particular in industrial systems for switching and controlling high currents and voltages. Thus, the electrical switchgear performs two important functions namely, switching on/off operations through dedicated electrical switches designed to establish and interrupt high currents; and providing protection against overloads and short-circuit conditions through suitable electrical protection devices.

Several electrical protection devices, such as those based on overload relays, depend on current sensing modalities such as current transformers to measure electrical current flowing in an electrical circuit.

In addition to electrical switchgear, as described above, current sensing modalities are similarly applicable in several other applications. In particular, several electrical devices such as electrical consumption metering devices and so on, also depend on such current sensing modalities, and current transformers are widely used with such electrical devices.

Current transformers facilitate measuring large currents, which often exist in many commercial and industrial applications. In a typical design of such current transformers, a non-insulated busbar or an insulated cable/ busbar is passed through an insulated core supporting a coil. The busbar forms a (single-turn) primary winding and the coil forms a (multi-turn) secondary winding of the current transformer. The primary winding of the current transformer carries the electrical current being provided to the electrical circuit to be protected; the electrical current in the secondary winding being proportional to the current in the primary winding provides a measure thereof. Thus, a current transformer facilitates measurement of high currents in the circuit to be protected through feeding proportionately reduced current to the control circuit; and therefore, current transformers are widely used in various applications.

The design of a current transform must ensure accurate and reliable current sensing in accordance with specific requirements of measurement and protection schemes. In particular, the core of the current transformer must have sufficient volume to preclude magnetic saturation during overload and short-circuit conditions. Accordingly, it is a common practice to use relatively large-sized current transformers. Such large-sized current transformers adversely impact the form-factor of resulting electrical protection device, and leads to inefficient space utilization with a switchgear cabinet in switchgear application, and analogous mounting assemblies in other applications.

In a large number of industrial and commercial applications, a three-phase electrical supply is used. In these cases, a combination of three current transformers is used, one each for individual phase in the electrical supply. Hence, the problem of inefficient space utilization becomes even more aggravated. In particular, spacing between individual busbars needs to be substantially large in order to accommodate

current transformers core and coil assemblies. Such form-factor does not match with spacing between individual phase elements in other electrical devices, such as an electrical contactor. Hence, special design features have to be provisioned in order to integrate current transformers with suitable electrical devices.

Over past years, several efforts have been made to achieve a more compact form-factor while meeting various electromagnetic performance requirements of the current transformers. However, these efforts have generally been directed towards developing specialized materials to be used for cores in the current transformers. While use of such specialized materials may help to achieve a more compact form-factor, the cost becomes increasingly prohibitive.

Evidently, it is required to devise alternative and cost-effective ways to reduce volumetric requirements of current transformers.

One important consideration with regard to volumetric requirements is packaging efficiency while assembling three current transformers in case of three-phase electrical supply. The predominant packaging configuration used in industry involves placing three current transformers next to each other in a lateral direction to yield an “aligned” configuration. It is desirable to improve the packaging efficiency of the current transformers to achieve more compact form-factor.

One technique known in the art teaches to arrange individual current transformers along faces of a triangular prism to yield a “staggered” configuration. However, such arrangement requires several additional components and more importantly, additional electrical connections leading to increased cost and inefficient operation.

As will be sufficiently clear from preceding description, while some attempts have been made to improve the packaging efficiency, no satisfactory alternative is currently available. Hence, the aligned configuration continues to be widely used in the industry.

In light of the foregoing, there is a need for providing an improved current transformer assembly for use in electrical protection devices such that a compact form-factor is achieved without adversely impacting cost, accuracy and operational efficiency; also, it is desirable that such improved current transformer assembly is adapted for an effective integration with suitable electrical devices.

Accordingly, an object of the present invention is to provide an improved current transformer assembly based on an improved arrangement thereof such that a compact form-factor is achieved, and an effective integration with suitable electrical devices is facilitated.

The object of the present invention is achieved by a current transformer assembly according to claim 1 and an electrical protection device according to claim 11. Further embodiments of the present invention are addressed in the dependent claims.

In a first aspect of the present invention, a current transformer assembly is provided. The current transformer assembly is adapted for sensing an electrical current flowing through an electrical circuit. The current transformer assembly comprises a busbar sub-assembly, a plurality of electromagnetic sub-assemblies, and a carrier frame.

The busbar sub-assembly includes a plurality of busbars. Each busbar is configured to be electrically connectable at opposite ends thereof to a supply-side terminal and a load-side terminal of the electrical circuit to establish an electrical connection there between. Thus, the electrical

current flowing from the supply-side terminal to the load-side terminal flows through the busbars. Each busbar acts a (single-turn) primary winding of the current transformer.

Each electromagnetic sub-assembly includes a core and a coil supported on the core. The coil includes multiple turns of an insulated wire and forms a (multi-turn) secondary winding of the current transformer.

The carrier frame includes a plurality of elongated tubular elements extending substantially along a longitudinal direction and arranged in a fixedly spaced relationship along a lateral direction. Each elongated tubular element is configured to permit a busbar to extend there through. In addition, each elongated tubular element is further configured to support one of the electromagnetic sub-assemblies such that at least a first and a second electromagnetic sub-assembly supported on a first and a second elongated tubular element respectively are arranged in a fixedly spaced relationship along the longitudinal direction.

Thus, the underlying idea of the present invention is to sufficiently stagger the electromagnetic sub-assemblies along the length of the busbars such that elongated tubular elements supporting the electromagnetic sub-assemblies are placed in close proximity limited to lateral width of one core, which is in contrast to lateral width of at least two cores in the current state of the art, leading to more efficient packaging of the current transformer and hence, more compact form-factor along a lateral dimension of the current transformer.

In accordance with an embodiment of the present invention, each elongated tubular element is provided with a support flange extending outwards from a periphery thereof and rigidly attached thereto. Further, the plurality of elongated tubular elements is provided with at least one retaining

member slidingly disposable thereon. Each retaining member is fixedly connectable to at least one of another retaining member and said support flanges in a spaced relationship along said longitudinal direction. In this arrangement, the electromagnetic sub-assembly is fixedly mounted on said elongated tubular element intermediate said support flange and one of said retaining members. According to these technical features, each electromagnetic sub-assembly is firmly supported on one of the elongated tubular element, and thus, the current transformer assembly of the present invention efficiently withstands mechanical shocks and vibrations. Further, such arrangement facilitates mounting of electromagnetic sub-assemblies of different dimensions, along the longitudinal direction, depending on an electrical rating of the current transformer assembly.

In accordance with another embodiment of the present invention, each elongated tubular element is provided with a support flange disposed at substantially a central portion thereof. The support flanges on adjacent elongated tubular elements are integrated to maintain the fixedly spaced relationship between the elongated tubular elements. Herein, the electromagnetic assemblies are disposed on spatially adjacent elongated tubular elements on opposite sides of the support flanges with reference to the longitudinal direction. Additionally, two retaining members corresponding to two ends of the plurality of elongated tubular elements along the longitudinal direction are used to fixedly mount the electromagnetic sub-assemblies on the elongated tubular elements. Each retaining member is a plate-like structure with a plurality of apertures formed therein such as to be slidingly disposable along the longitudinal direction onto the plurality of elongated tubular elements from corresponding end thereof. The two retaining members are fixedly interconnected to each other. These technical features ensure a compact form-factor and advantageously facilitate assembling of the current transformer assembly. Further, each electromagnetic sub-assembly is firmly

supported on one of the elongated tubular element, and thus the current transformer assembly of the present invention remains stable even when subjected to mechanical shocks and vibrations. Furthermore, such arrangement facilitates mounting of electromagnetic sub-assemblies of different dimensions, along the longitudinal direction, depending on an electrical rating of the current transformer assembly.

In accordance with another embodiment of the present invention, the carrier frame includes a mounting platform adapted for mounting an electrical device thereon. Further, the coil in each electromagnetic sub-assembly is configured to be operably connected to the electrical device. In various exemplary embodiments of the present invention, the electrical device is one of an electrical tripping device, an electrical metering device, and an intelligent electronic device communicatively coupled to a control network. According to these technical features, the present invention advantageously facilitates an integrated current transformer assembly which senses an electrical current in an electrical circuit and appropriately processes the sensed electrical current through the electrical device.

In accordance with another embodiment of the present invention, the current transformer assembly includes housing. The housing includes at least two complementary housing portions which are assembled in an abutting manner to form an enclosed space therein. The housing provides a plurality of slots suitable for permitting the bus bars to extend there through.

In a second aspect of the present invention, an electrical protection device is provided. The electrical protection device is adapted for protecting electrical circuits under over-current related fault conditions. The electrical protection device includes an electrical tripping device. The electrical protection device has a basic construction essentially similar to that of the current transformer

assembly. In addition, the carrier frame includes a mounting platform adapted for mounting the electrical tripping device thereon. The coils in each electromagnetic sub-assembly are operably connected to the electrical tripping device.

Various other technical features in the second aspect of the present invention are similar to those described in conjunction with the first aspect.

The present invention is further described hereinafter with reference to illustrated embodiments shown in the accompanying drawings, in which:

FIGS 1A-1B illustrate a perspective view and a partially exploded view of a current transformer assembly in accordance with an embodiment of the present invention, and

FIGS 2A-2C illustrate partial perspective views of the current transformer assembly in accordance with an embodiment of the present invention.

Various embodiments are described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purpose of explanation, numerous specific details are set forth in order to provide a thorough understanding of one or more embodiments. It may be evident that such embodiments may be practiced without these specific details.

Referring to FIGS 1A and 1B, a perspective view and a partially exploded view of an electrical protection device 100 are shown in accordance with an embodiment of the present invention.

The current transformer assembly 100 is adapted for sensing an electrical current in a three-phase electrical circuit. The current transformer assembly 100 includes a busbar sub-

assembly 102, multiple electromagnetic sub-assemblies 104, a carrier frame 110, an electrical device 112, and a housing 114. Each electromagnetic sub-assembly 104 includes a core 106 and a coil 108.

The busbar sub-assembly 102 includes a plurality of busbars 102a through 102c. Each busbar 102 corresponds to a single phase in the electrical circuit. As evident from the figure, the current transformer assembly 100 is configured to be used in a three-phase electrical circuit. Each busbar is an integral metal strap with tapped holes at its two ends, as shown in the adjoining figures. Thus, each busbar 102 is configured to be electrically connectable at opposite ends thereof to a supply-side terminal (not shown) and a load-side terminal (not shown) of the electrical circuit to establish an electrical connection there between. When the busbar 102 is connected to the supply-side and the load-side terminals as described earlier, the electrical current flowing from the supply-side terminal to the load-side terminal in each phase flows through the corresponding busbar 102. Each busbar acts a (single-turn) primary winding of the current transformer assembly 100. In alternative embodiments of the present invention, any known construction of the busbars 102 may be used as appropriate.

As mentioned earlier, each electromagnetic sub-assembly 104 includes a core 106 and a coil 108. In a preferred embodiment of the present invention, the core 106 has a hollow rectangular frame-like construction such as to be suitable for mounting on the carrier frame 110. The coil 108 is supported on the core 106 in a suitable manner as known in the art. In an exemplary embodiment of the present invention, in order to achieve a compact form-factor, the coil 108 is mounted only on one or both legs of the rectangular frame extending along the lateral direction (x-axis) and legs of the rectangular frame extending along transverse direction (z-axis) do not support the coil 108. The coil 108 includes

multiple turns of an insulated wire and forms (multi-turn) secondary winding of the current transformer assembly 100.

The carrier frame 110 is made of an electrically insulating material. In a preferred embodiment of the present invention, the carrier frame 110 has a monolithic design and is manufactured through casting a suitable electrically insulating material in molten form. In alternative examples of the present invention, it is readily possible to manufacture the carrier frame 110 through assembling modular sub-components.

The carrier frame 110 is adapted to support the busbar sub-assembly 102, the electromagnetic sub-assembly 104, and the electrical device 112. The construction and manner in which these components are supported on the carrier frame 110 will be explained in more detail in conjunction with FIGS 2A through 2C.

It should be noted that the electrical device 112 is an optional component and may be provided when it is desirable to process the electrical current sensed through the combination of primary and secondary windings. The electrical device 112 is any suitable device that requires as an input a measure of the electrical current in the electrical circuit and performs one or more steps based on such input. Towards this end, the coil 108 in each electromagnetic sub-assembly 104 is configured to be operably connected to the electrical device 112. In various exemplary embodiments of the present invention, the electrical device 112 is one of an electrical tripping device; an electrical metering device; and an intelligent electronic device communicatively coupled to a control network. Therefore, the present invention advantageously facilitates an integrated current transformer assembly which senses an electrical current in an electrical circuit and appropriately processes the sensed electrical current through the electrical device.

When the electrical device is an electrical tripping device, it is configured to generate a trip signal based on an electrical current flowing through the electrical circuit exceeding a predefined threshold for at least a predefined time interval. The measure of electrical current in the electrical circuit is provided to the electrical device from the coil 108. Various examples of such electrical tripping devices bimetallic overload relays, electronic overload relays, and such intelligent electronic devices that are configurable to generate and communicate a trip signal. Hence, the term 'electrical tripping device' should be construed in its broadest possible sense and is not intended to be limited to any specific modality for generating the trip signal. In this embodiment, the integrated current transformer assembly 100 is used as an "electrical protection device" adapted to protect the electrical circuit from such fault conditions that lead to over-currents in the electrical circuit.

Similarly, when the electrical device is an electrical metering device, it is configured to maintain a record of power consumption on the load-side of the electrical circuit. Such information may further be used for billing and other purposes.

Further, when the electrical device is an intelligent electronic device communicatively coupled to a control network, the electrical device provides information related to the electrical current in the electrical circuit to one or more control and monitoring modules in the control network.

Various components described above are enclosed in the housing 114. As shown particularly in FIG 1B, the housing 114 includes at least two complementary housing portions 114a and 114b which are assembled in an abutting manner to form an enclosed space therein. The housing 114 provides a plurality of slots suitable for permitting the bus bars to extend there through. Further, optionally, a desired number of additional

slots of suitable form-factor are provided to permit access to the electrical device. In case an integrated electrical device, as described above, is not used, then additional slots are required to provide access to the coils 108 in electromagnetic sub-assemblies 104. It should be noted that an additional housing portion 114c, shown in the adjoining figure, provides an aesthetic function only and hence, if desirable, may be omitted.

The operation of the current transformer assembly 100 is as known in the art and will now be briefly explained for the sake of completion.

The busbars 102 carry the electrical current from the supply-side to the load-side in the electrical circuit and serve as the primary winding of the current transformer assembly 100. Owing to the electrical current in the busbars 102, a proportionate current is induced in the secondary winding forming the coil 108. If the electrical device 112 is present, the induced current in the coil 108 is provided thereto, otherwise, leads of the coil 108 are accessed through appropriate slots in the housing 114. When present, the electrical device 112 in turn may send out signals from within the housing 114 to one or more devices located outside the housing 114.

Referring now to FIGS 2A through 2C, partial perspective views of the current transformer assembly in accordance with an embodiment of the present invention.

In particular, FIG 2A provides a perspective view of carrier frame 110. The carrier frame 110 includes multiple elongated tubular elements 202. The carrier frame 110 shown in adjoining figure shows three such elongated tubular elements 202. This configuration is suitable when the current transformer assembly 100 is to be used in a three-phase electrical circuit.

The elongated tubular elements 202 extend substantially along a longitudinal direction (y-axis) and are arranged in a fixedly spaced relationship along a lateral direction (x-axis).

Each elongated tubular element 202 is configured to permit the busbar 102 to extend there through. In addition, each elongated tubular element 202 is configured to support one of the electromagnetic sub-assemblies 104, as shown in FIG 2B.

According to various embodiments of the present invention, at least a first electromagnetic sub-assembly and a second electromagnetic sub-assembly (e.g. electromagnetic sub-assemblies 114a and 114b respectively) supported respectively on a first elongated tubular element and a second elongated tubular element (e.g. elongated tubular elements 202a and 202b respectively) are arranged in a fixedly spaced relationship along the longitudinal direction (y-axis). The foregoing is valid for any pair of electromagnetic sub-assemblies 104 disposed on adjacent pairs of elongated tubular elements 202.

Thus, the electromagnetic sub-assemblies 104 are staggered along the length of the busbars 102, which extend through the elongated tubular elements 202 and consequently also aligned along the longitudinal direction (y-axis), such that elongated tubular elements 202 supporting the electromagnetic sub-assemblies 104 are advantageously placed in closer proximity leading to more efficient packaging of the current transformer assembly 100 and hence, a more compact form-factor along a lateral direction (x-axis) of the current transformer assembly 100.

As mentioned in foregoing description, the carrier frame 110 supports the electromagnetic sub-assemblies 104. This aspect will now be described in more detail.

Each elongated tubular element 202 is provided with a support flange 204 extending outwards from a periphery thereof and rigidly attached thereto. The support flange 204 is preferably created as an integrated structure during the casting of the carrier frame 110. Alternatively, the support flange 204 may be separately formed and attached to the elongated tubular element 202 during the assembling process.

In addition, the plurality of elongated tubular elements 202 is provided with at least one retaining member 206 slidingly disposable thereon. In one embodiment of the present invention, shown in FIG 2C, two such retaining members 206a and 206b are used. The retaining members 206a and 206b are inserted from opposite ends onto the elongated tubular elements 202 and then, fixedly connected to each other through a strap arrangement 208. In an alternative embodiment, individual retaining members 206 are used for each elongated tubular element 202. Herein, each retaining member 206 is fixedly connected to a corresponding support flange 204 through a strap arrangement, similar to the strap arrangement 208. In both embodiments, the one or more retaining members 206 are fixedly held in a spaced relationship from the support flanges 204 along the longitudinal direction (y-axis).

Each electromagnetic sub-assembly 104 is fixedly mounted on corresponding elongated tubular element 202 between the support flange 204 and one of the retaining members 206. Thus, such arrangement advantageously facilitates mounting of electromagnetic sub-assemblies of different core dimensions (along the longitudinal direction) depending on an electrical rating of the current transformer assembly.

In a specific embodiment of the present invention, as shown in FIGS 2A through 2C, each elongated tubular element 202 is provided with a support flange 202 disposed at substantially a central portion thereof. The support flanges 204 on adjacent elongated tubular elements 202 are integrated to

maintain the fixedly spaced relationship between the elongated tubular elements 202. As will be readily apparent, the carrier frame 110 may be easily manufactured as a monolithic unit using a casting process.

In this particular embodiment, the electromagnetic sub-assemblies 104 are disposed on spatially adjacent elongated tubular elements 202 on opposite sides of the support flanges 204 with reference to the longitudinal direction (y-axis) as shown in FIGS 2B and 2C. Additionally, two retaining members 206a and 206b corresponding to two ends of the plurality of elongated tubular elements 202 along the longitudinal direction (y-axis) are used to fixedly mount the electromagnetic sub-assemblies 104 on the elongated tubular elements 202.

As shown in the adjoining figure, each retaining member 206 is a plate-like structure with a plurality of apertures formed therein such as to be slidingly disposable along the longitudinal direction (y-axis) onto the elongated tubular elements 202 from corresponding end thereof. The two retaining members 206 are fixedly interconnected to each other.

The strap arrangement 208 used to fixedly interconnect the two retaining members 206 may be formed using integrally attached straps to each retaining member 206 such that the retaining members 206 are connectable in a pair-wise manner wherein at least one strap on a first retaining member, for example the retaining member 206a, is provided with a suitable mating means to be attached to another strap on a second retaining member, for example the retaining member 206b.

In an exemplary embodiment of the present invention, the strap arrangement 208 includes a singular strap which is wound around the carrier frame 110, after mounting the electromagnetic sub-assemblies 104 and the retaining members

206, in a belt-like manner. In this example, the strap include a buckle-like structure at one end of the strap and the other end of the strap includes striations formed therein, such that said other end pass through the buckle-like structure in a forward direction and is prevented from moving in a backward direction, which is opposite to said forward direction.

The essential design feature of the strap arrangement 208 is to ensure that desired interconnection can be made at variable lengths such that different electromagnetic sub-assemblies 104 can be suitably supported on the carrier frame 110.

As will be apparent, several alternative strap arrangements are readily possible, and any such suitable strap arrangement known in the art may be used in the present invention.

Further, the carrier frame 110 is provided with a mounting platform 210 which is adapted for mounting the electrical device 112 thereon. In one example, as can be seen in the adjoining figures, the mounting platform 210 rises along z-axis and is positioned substantially parallel to the plane corresponding to the longitudinal and the lateral directions (x-y plane). However, various modifications are possible in the orientation of the mounting platform 210. Additionally, the carrier frame 110 is provided with engaging means 212 such that it is removably coupled to the housing 114.

The present invention facilitates a more efficient packaging of the current transformer assembly and hence, more compact form-factor along a lateral dimension of the current transformer assembly. Further, the current transformer assembly of the present invention facilitates easy and effective integration with suitable electrical devices.

The design of the present invention advantageously facilitates assembling of the current transformer assembly.

Importantly, such arrangement facilitates mounting of electromagnetic sub-assemblies of different dimensions (along the longitudinal direction) depending on electrical ratings of the current transformer assembly. In addition, the current transformer assembly of the present invention provides has a robust construction and efficiently withstands mechanical shocks and vibrations.

While the present invention has been described in detail with reference to certain embodiments, it should be appreciated that the present invention is not limited to those embodiments. In view of the present disclosure, many modifications and variations would present themselves, to those of skill in the art without departing from the scope and spirit of this invention. The scope of the present invention is, therefore, indicated by the following claims rather than by the foregoing description. All changes, modifications, and variations coming within the meaning and range of equivalency of the claims are to be considered within their scope.

LIST OF REFERENCES

100 CURRENT TRANSFORMER ASSEMBLY
102 BUSBAR SUB-ASSEMBLY
104 ELECTROMAGNETIC SUB-ASSEMBLY
106 CORE
108 COIL
110 CARRIER FRAME
112 ELECTRICAL DEVICE
114 HOUSING

202 ELONGATED TUBULAR ELEMENT
204 SUPPORT FLANGE
206 RETAINING MEMBER
208 STRAP ARRANGEMENT
210 MOUNTING PLATFORM
212 ENGAGING MEANS

Claims:

1. A current transformer assembly (100), said current transformer assembly (100) adapted for sensing an electrical current flowing through an electrical circuit, said current transformer assembly (100) comprising:
- a busbar sub-assembly (102), said busbar sub-assembly (102) comprising a plurality of busbars (102), wherein each busbar (102) is configured to be electrically connectable at opposite ends thereof to a supply-side terminal and a load-side terminal of said electrical circuit to establish an electrical connection there between,
- a plurality of electromagnetic sub-assemblies (104), wherein each electromagnetic sub-assembly (104) comprises a core (106) and a coil (108) supported on said core (106), and
- a carrier frame (110), said carrier frame (110) comprising a plurality of elongated tubular elements (202) extending substantially along a longitudinal direction (y-axis) and arranged in a fixedly spaced relationship along a lateral direction (x-axis), wherein each elongated tubular element (202) is configured to permit a busbar (102) to extend there through, and further configured to support one of said electromagnetic sub-assemblies (104) such that at least a first and a second electromagnetic sub-assembly (104a and 104b) supported on a first and a second elongated tubular element (202a and 202b) respectively are arranged in a fixedly spaced relationship along said longitudinal direction (y-axis).

2. The current transformer assembly (100) according to claim 1, wherein each elongated tubular element (202) is provided with a support flange (204) extending outwards from a periphery thereof and rigidly attached thereto, and further said plurality of elongated tubular elements (202) is provided with at least one retaining member (206) slidingly disposable thereon, and each retaining member (206) being

fixedly connectable to at least one of another retaining member (206) and said support flanges (204) in a spaced relationship along said longitudinal direction (y-axis), and further wherein said electromagnetic sub-assembly (104) is fixedly mounted on said elongated tubular element (202) intermediate said support flange (204) and one of said retaining members (206).

3. The current transformer assembly (100) according to claim 1, wherein each elongated tubular element (202) is provided with a support flange (204) disposed at substantially a central portion thereof, and said support flanges (204) on adjacent elongated tubular elements (202) are integrated to maintain said fixedly spaced relationship between said elongated tubular elements (202).

4. The current transformer assembly (100) according to claim 3, wherein said electromagnetic sub-assemblies (104) are disposed on spatially adjacent elongated tubular elements (202) on opposite sides of said support flanges (204) with reference to said longitudinal direction (y-axis).

5. The current transformer assembly (100) according to any of claims 3 or 4 further comprising at least two retaining members (206) corresponding to two ends of said plurality of elongated tubular elements (202) along said longitudinal direction (y-axis), wherein each retaining member (206) is a plate-like structure with a plurality of apertures formed therein such as to be slidingly disposable along said longitudinal direction (y-axis) onto said plurality of elongated tubular elements (202) from corresponding end thereof, and wherein said retaining members (206) are fixedly interconnected to each other.

6. The current transformer assembly (100) according to any of claims 1 to 5, wherein said carrier frame (110) further comprises a mounting platform (210) adapted for mounting an electrical device (112) thereon; and wherein said coil (108)

in each electromagnetic sub-assembly (104) is configured to be operably connected to said electrical device (112).

7. The current transformer assembly (100) according to claim 6, wherein said electrical device (112) is an electrical tripping device.

8. The current transformer assembly (100) according to claim 6, wherein said electrical device (112) is an electrical metering device.

9. The current transformer assembly (100) according to claim 6, wherein said electrical device (112) is an intelligent electronic device communicatively coupled to a control network.

10. The current transformer assembly (100) according to any of the preceding claims further comprising a housing (114), wherein said housing (114) comprises at least two complementary housing portions (114a, 114b) assembled in an abutting manner to form an enclosed space therein, wherein said housing (114) provides a plurality of slots suitable at least for permitting said busbars (102) to extend there through.

11. An electrical protection device (100), said electrical protection device (100) adapted for protecting an electrical circuit under over-current related fault conditions, said electrical protection device (100) comprising:
- an electrical tripping device (112),
- a busbar sub-assembly (102), said busbar sub-assembly (102) comprising a plurality of busbars (102), wherein each busbar (102) is configured to be electrically connectable at opposite ends thereof to a supply-side terminal and a load-side terminal of said electrical circuit to establish an electrical connection there between,
- a plurality of electromagnetic sub-assemblies (104), wherein each electromagnetic sub-assembly (104) comprises a core (106) and a coil (108) supported on said core (106),

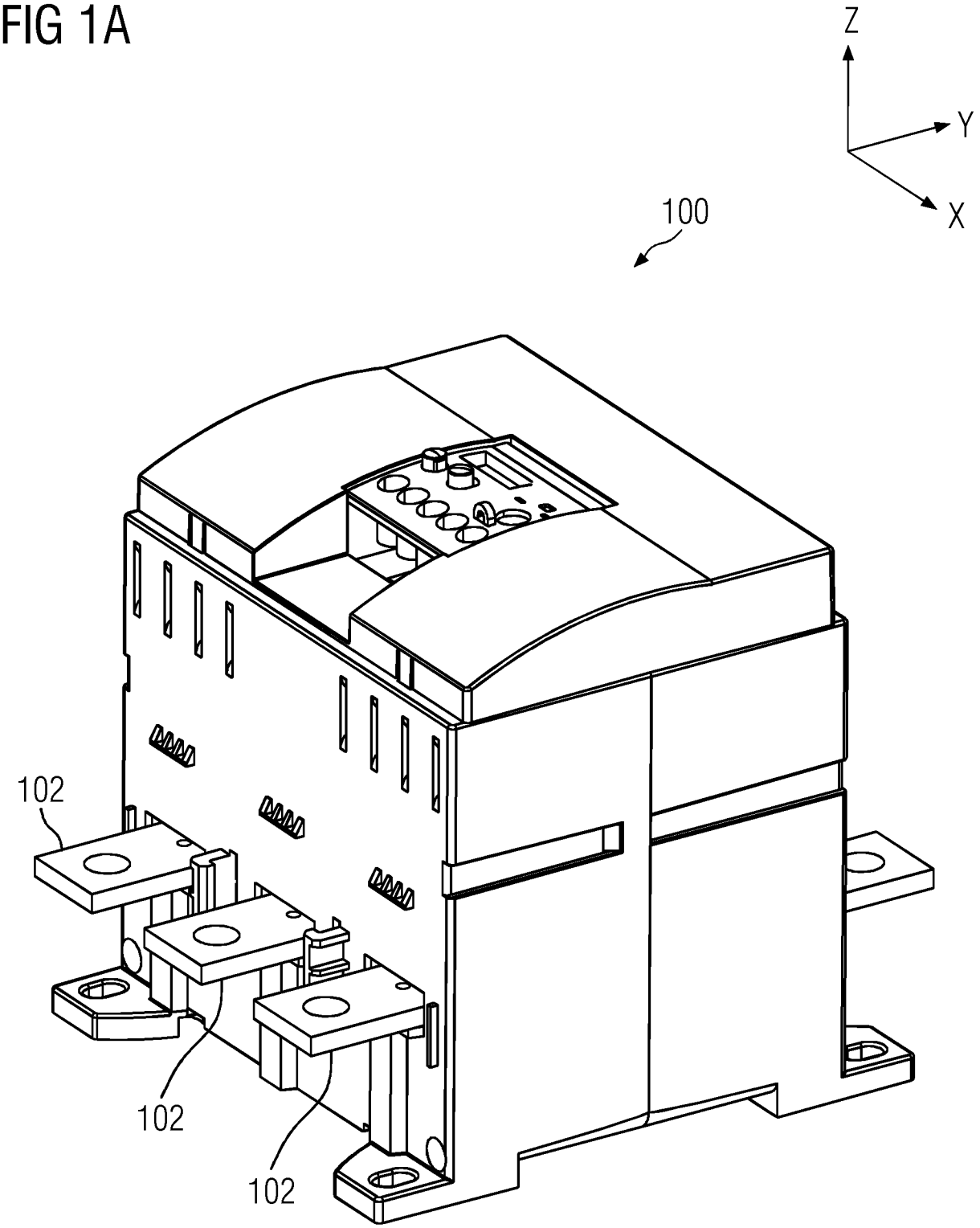
wherein said coil (108) is operably connected to said electrical tripping device (112) , and
- a carrier frame (110), said carrier frame (110) comprising a mounting platform (210) adapted for mounting said electrical tripping device (112) thereon, and said carrier frame (110) further comprising a plurality of elongated tubular elements (202) extending substantially along a longitudinal direction (y-axis) and arranged in a fixedly spaced relationship along a lateral direction (x-axis), wherein each elongated tubular element (202) is configured to permit a busbar (102) to extend there through, and further configured to support one of said electromagnetic sub-assemblies (104) such that at least a first and a second electromagnetic sub-assembly (104a, 104b) supported on a first and a second elongated tubular element (202a, 202b) respectively are arranged in a fixedly spaced relationship along said longitudinal direction (y-axis).

12. The electrical protection device (100) according to claim 11, wherein each elongated tubular element (202) is provided with a support flange (204) extending outwards from a periphery thereof and rigidly attached thereto, and further said plurality of elongated tubular elements (202) are provided with at least one retaining member (206) slidingly disposable thereon, and each retaining member (206) being fixedly connectable to at least one of another retaining member (206) and said support flanges (204) in a spaced relationship along said longitudinal direction (y-axis), and further wherein said electromagnetic sub-assembly (104) is fixedly mounted on said elongated tubular element (202) intermediate said support flange (204) and one of said retaining members (206).

13. The electrical protection device (100) according to any of the preceding claims further comprising a housing, wherein said housing (114) comprises at least two complementary housing portions (114a, 114b) assembled in an abutting manner to form an enclosed space therein, wherein said housing (114)

provides a plurality of slots suitable at least for permitting said busbars (102) to extend there through.

FIG 1A



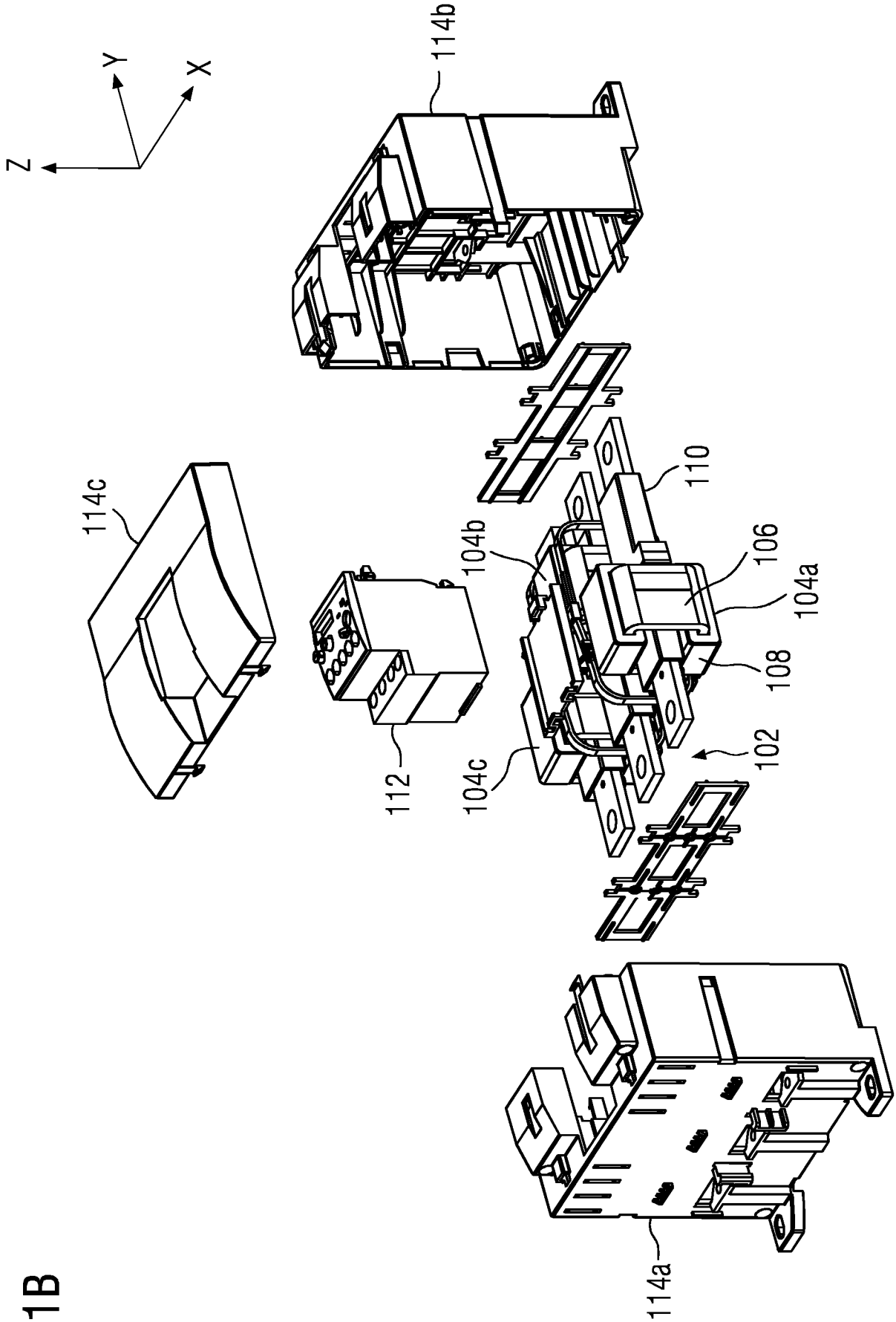


FIG 1B

FIG 2A

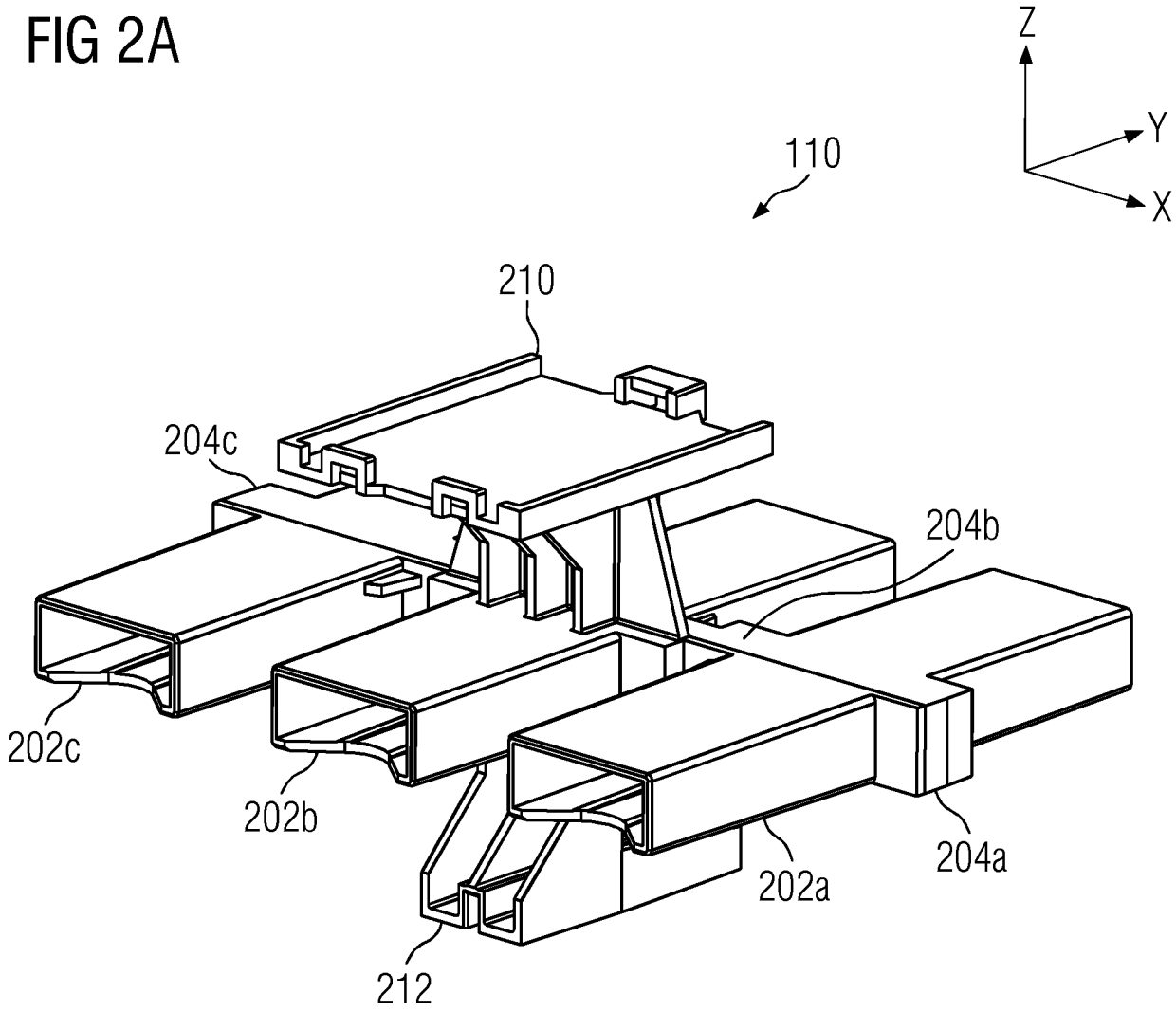


FIG 2B

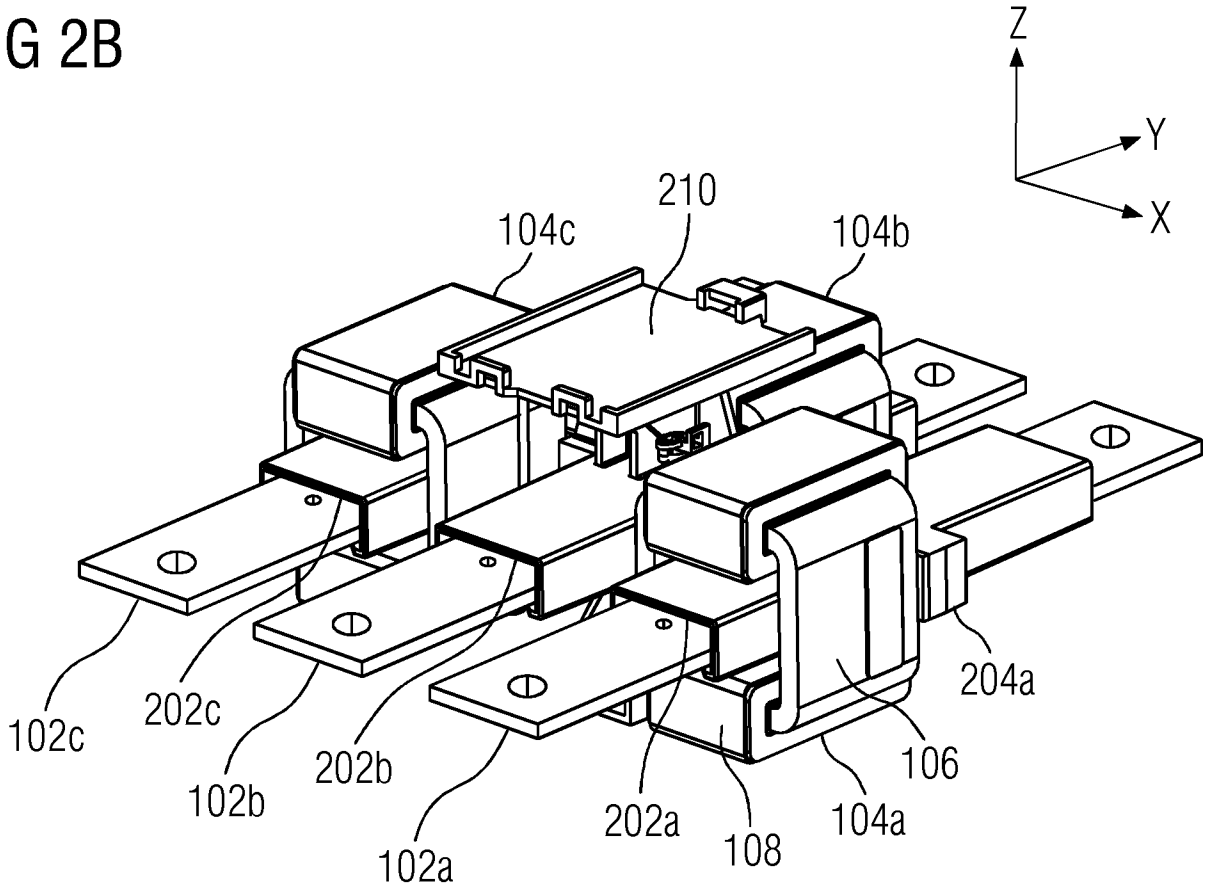
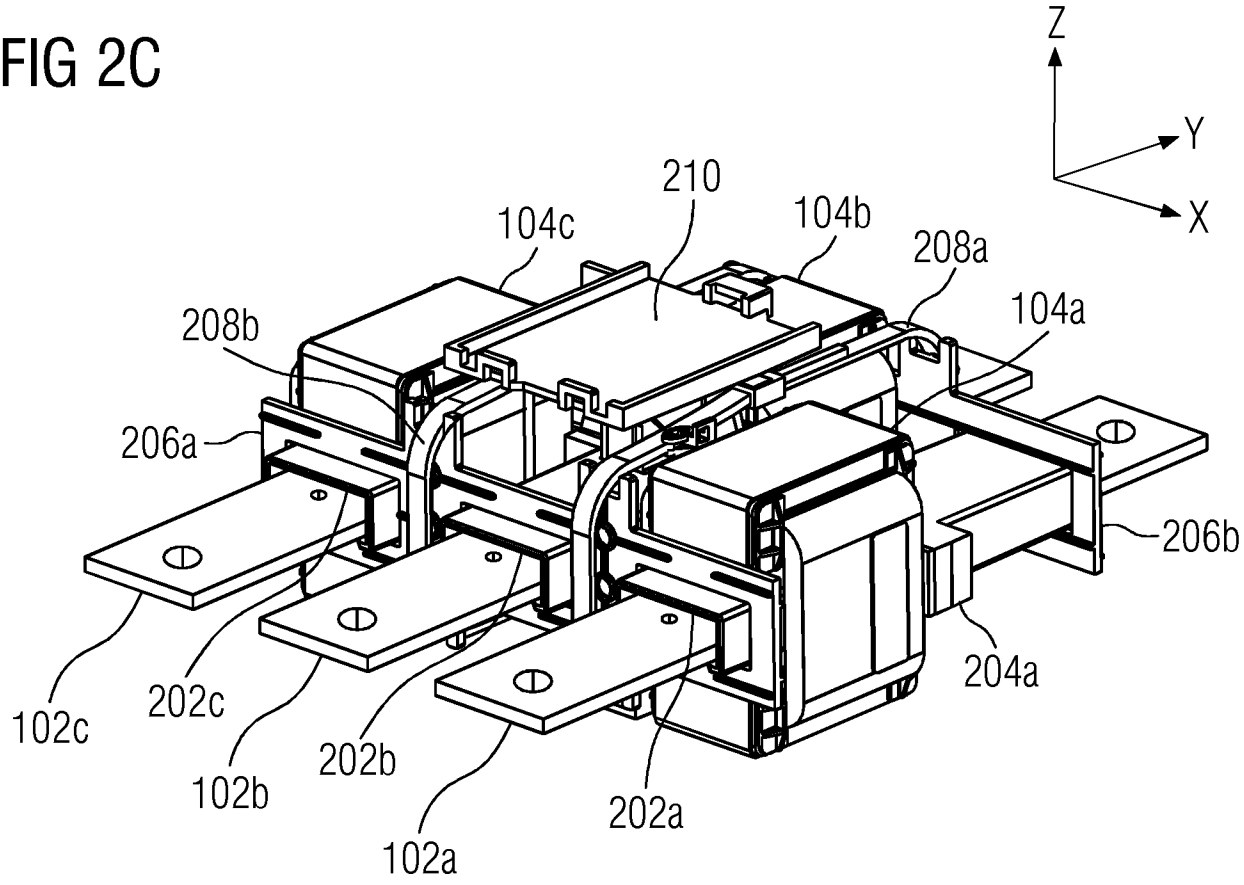

Z
Y
X
210
104c
104b
204a
102c
202c
202b
102b
106
202a
104a
108
102a

FIG 2C


Z
Y
X
210
104c
104b
208a
104a
208b
206a
206b
204a
102c
202c
202b
102b
202a
102a

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/062823

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01F27/06 H01F38/30 H01F38/38 H01H71/12 H02H1/00
ADD.

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)
H01F H01H H02H

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)

EPO-Internal, WPI Data

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Y	abstract; figures 1-8 page 6, line 10 - line 19 page 8, line 27 - page 9, line 22 page 10, line 10 - line 21; claim 1	7-9, 11-13

X	EP 1 120 659 A1 (SOCOMEC SA [FR]) 1 August 2001 (2001-08-01)	1-3,5,10
A	abstract; figures 1-6	11-13

X	US 2006/258204 A1 (PREUHS ALLEN V [US] ET AL) 16 November 2006 (2006-11-16)	1
A	abstract; figures 17-20	11

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 April 2013	23/04/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Rouzier, Brice

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International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	abstract; figures 1,2	11

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