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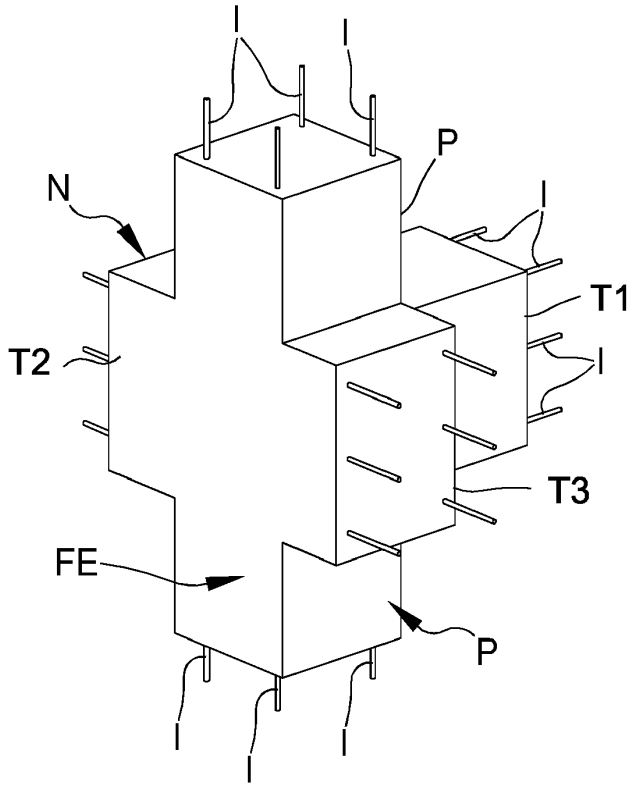
(54) **REINFORCING EQUIPMENT**

(57) Equipment (1) for reinforcing a node (N) of a not entirely confined type of a reinforced concrete frame; the node (N) being arranged at the intersection of at least one beam (T1, T2, T3) and one pillar (P) reinforced longitudinally and being delimited externally by a first external face (FE) in which a substantially prismatic recess (R) is obtained delimited peripherally by a surface (S) that has a first perimeter (P1) having a given shape and at the bottom by a second internal face (FI); a plate (10) being peripherally delimited by a second perimeter (P2) having a geometrically similar shape to the first perimeter (P1) and having a given thickness; attachment means (20) being provided for connecting the plate (10) to the second face (FI) .

Fig.1



EP 4 321 708 A1

Description

[0001] The present invention relates to reinforcing equipment. In particular, the present invention refers to equipment for reinforcing a node of a not entirely confined type of a reinforced concrete frame. In more detail, the present invention refers to equipment for reinforcing a node of a not entirely confined type of a reinforced concrete frame where said node being arranged at the intersection of at least one beam and one pillar reinforced longitudinally.

DESCRIPTION OF THE BACKGROUND ART

[0002] In the building sector it is known to produce reinforced concrete frames that are combinations of beams and pillars provided internally with metallic structures comprising so-called "bars" arranged longitudinally to resist bending and/or torsional stresses that the concrete would be unable to effectively resist. These bars are normally arranged in given positions according to design specifications determined through the use of metallic brackets, partly within a perimeter that will define the beams and the pillars and partly on the external perimeter. The overall shape of the beams and of the pillars of the frame is determined by formworks that delimit the space in which the bars and the brackets of the beams and of the pillars are arranged, space that will be filled by pouring concrete. We refer to nodes of an entirely confined type when the beams leading to the nodes engage all the sides of the corresponding pillar, while we refer to nodes of a not entirely confined type when the beams leading to the nodes engage only a part of the peripheral sides of the corresponding pillar.

[0003] In some cases the bars that correspond to the nodes are without brackets; this can occur due to a defect in longitudinal anchoring of the brackets or also due to failure to provide this type of constraint. In any case, the effect that this determines is a local structural incapacity of the node to resist seismic stresses, which is likely to be followed by inflection of the bars leading to the node, horizontal if of beams and vertical if of pillars. This inflection corresponds simultaneously to the application of a transverse force on the coating layer of the node, more briefly known as "concrete cover", which thus yields leaving the bars uncovered.

[0004] Naturally, when following technical evaluation it is understood that the nodes of a building have been executed to resist loads lower than those hypothesized according to more conservative seismic models than those adopted in the design phase, it is possible to take action to make them safe, with the overall effect of structurally upgrading the building.

[0005] One of the least invasive manners is that of taking action on these nodes from the outside, with reinforcement works. In some cases, action is taken by associating additional structural systems, capable of entirely resisting the seismic action that it is deemed must actually be counteracted in situ, with the nodes. This manner consists of enveloping the building with a new reinforced concrete wall connected to the existing wall via connectors positioned at the level of the bond beams. This operation is in fact carried out remaining on the outside of the building, so that existing finishes and plants remain intact.

[0006] It can be easily understood that it is not always possible to use this solution: in fact, it requires the building to be separate from other constructions and sufficient space along the entire perimeter in order to carry out the works. Moreover, bond beams to which to connect the new walls must be present. Therefore, the operation requires the use of scaffolding, which must remain installed for the whole of the duration of the operation which, requiring the use of concrete, will be particularly lengthy, requiring the use of formworks and the waiting for the time it takes for the concrete to cure. Obviously, this causes drawbacks for those living in the buildings that are to be made safe using this technology, both due to the high cost and due to the need to modify, even only temporarily, their daily habits related to the way in which they interact with the building.

[0007] For the reasons described above, there is currently no solution to the problem of making buildings with a reinforced concrete frame and with nodes of a not entirely confined type safe through technologies that allow the aforesaid drawbacks to be prevented, and this represents an interesting challenge for the applicant that is oriented at minimizing the impact of the maintenance interventions of buildings on people living in them even for only a few hours a day.

[0008] The comparative study of equipment for reinforcing areas of convergence or nodes of beams and pillars of building structures disclosed the prior art patent IT 102012902092417 and the patent KR 101 999 527, neither of which offers teachings useful to overcome the drawbacks described above.

[0009] In view of the situation described above, it would be desirable to have a technology for reinforcing a node of a not entirely confined type of a reinforced concrete frame that, in addition to limiting and possibly overcoming the drawbacks typical of the state of the art described above, defines a new standard for these types of applications.

SUMMARY OF THE PRESENT INVENTION

[0010] The present invention relates to reinforcing equipment. In more detail, the present invention refers to equipment for reinforcing a node of a not entirely confined type of a reinforced concrete frame; said node being arranged at the intersection of at least one beam and one pillar reinforced longitudinally.

[0011] The drawbacks set forth above are solved by the present invention, according to at least one of the appended claims.

[0012] According to some embodiments of the present

invention, there is provided equipment for reinforcing a node of a not entirely confined type of a reinforced concrete frame; said node being arranged at the intersection of at least one beam and one pillar reinforced longitudinally and being delimited externally by a first external face in which a substantially prismatic recess is obtained delimited peripherally by a surface that has a first perimeter having a given shape and at the bottom by a second internal face; said equipment comprising a plate peripherally delimited by a second perimeter having a geometrically similar shape to said first perimeter and having a given thickness; attachment means being provided for connecting said plate to said second face.

[0013] According to an embodiment as described above, said second face is distant from said first face by a length that exceeds said given thickness of said plate; said node having a plurality of holes made in said second face; said attachment means comprising a plurality of screws each for engaging said node in a respective said hole so as to couple said plate to said node internally to said recess. According to an embodiment as described above, there is provided a coating layer of concrete having the function of a concrete cover that engages said recess in external contact with said plate.

[0014] According to an embodiment as described above, said layer is externally delimited by a third face coplanar to said first external face.

[0015] According to an embodiment as described above, said first face is flat and said plate is flat.

[0016] According to an embodiment as described above, said first face is angled and said plate is angled.

[0017] According to an embodiment as described above, the equipment comprises adjustment members of the position of said plate relative to said second face.

[0018] According to an embodiment as described above, said adjustment members comprise at least three ferrules screw-adjustable in height which transversely engage said plate. According to an embodiment as described above, said plate has lightening slots engageable by said coating layer. According to some embodiments of the present invention, there is provided a method for reinforcing a node of a not entirely confined type of a reinforced concrete frame; said node being arranged at the intersection of at least two longitudinally reinforced beams and a pillar and being delimited externally by a first external face; said method comprising a step of obtaining a recess in said node as a projection of a beam of said at least two beams; said recess being substantially prismatic and delimited peripherally by a surface that has a first perimeter having a given shape and at the bottom by a second internal face; a step of housing a plate delimited by a second perimeter having a geometrically similar shape to said first perimeter and having a given thickness within said recess; a step of attaching said plate to said second face. According to an embodiment as described above, the method comprises a step of obtaining a plurality of holes in said second face; a step of engaging each hole of said plurality of holes with a screw of said plurality of screws so as to couple said plate to said node internally to said recess. According to an embodiment as described above, the method comprises a step of covering said plate with a coating layer of concrete having the function of a concrete cover. According to an embodiment as described above, said first face is flat and said plate is flat.

[0019] According to an embodiment as described above, said first face is angled and said plate is angled.

[0020] According to an embodiment as described above, the method comprises a step of adjusting the position of said plate relative to said second face by screw adjustment members. Any further embodiments of the present utility model are defined by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Further features and advantages of the reinforcing equipment according to the present invention will be more apparent from the following description, illustrated with reference to the accompanying figures, which show at least one non-limiting example of embodiment thereof, wherein identical or corresponding parts of the equipment are identified by the same reference numbers. In particular:

- Fig. 1 is a schematic perspective view of a node of a not entirely confined type of a reinforced concrete frame;
- Fig. 1 bis is an exploded schematic perspective view of a first embodiment of equipment according to the present invention;
- Fig. 2 is a front elevation view of Fig. 1 bis with the related equipment installed;
- Fig. 3 is a sectional view along the line III-III of Fig. 2;
- Fig. 4 is a sectional view along the line IV-IV of Fig. 2;
- Fig. 5 is a schematic perspective view of a construction step in which the equipment of Fig. 1 bis is applied to Fig. 1;
- Fig. 6 is a schematic perspective view of a construction step in which a second preferred embodiment of the equipment of Fig. 1bis is applied to Fig. 1;
- Fig. 7 and Fig. 8 show a construction detail extracted from Fig. 5 and a construction detail extracted from Fig. 6, respectively;
- Fig. 9 is an exploded schematic perspective view of a third embodiment of the equipment of Fig. 2;
- Fig. 10 is a front elevation view of Fig. 9 with the related equipment installed; and
- Fig. 11 is a sectional view along the line XI-XI of Fig. 10.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0022] Before describing the preferred embodiments of the present invention or details thereof in detail, it is considered useful to specify that the related scope of

protection is not limited to the particular embodiments described below. The disclosure and the description in the present document illustrate and describe one or more currently preferred embodiments and variations, and it will be apparent to those skilled in the art that various changes may be made to the design, to the organization, to the operating order, to the operating means, to the structures of the equipment and position, and to the methods and use of mechanical equivalents without departing from the spirit of the present invention.

[0023] Moreover, it must be understood that the accompanying drawings are provided for the purpose of clearly illustrating and disclosing currently preferred embodiments to a person skilled in the art, but are not drawings that illustrate how to implement these embodiments in actual fact or true representations of final products; on the contrary, these figures can comprise simplified conceptual views to facilitate understanding or provide a simpler and quicker explanation. Furthermore, the dimensions and the related arrangement of the components can differ from those shown and still operate within the spirit of the present invention.

[0024] Furthermore, it will be understood that various directions such as "upper", "lower", "left", "right", "front", "rear" and so forth are implemented only in relation to the explanation in combination with the drawings and that the components can be oriented differently, for example during transport and production, as well as during operation. As many different and distinct embodiments can be made within the scope of the concepts taught herein, and as many changes can be made to the embodiments described herein, it must be understood that the details provided below are to be interpreted as illustrative and non-limiting of the spirit of the present invention.

[0025] In Fig. 1, 1 indicates, as a whole, a first embodiment of equipment 1 for reinforcing a node N of a not entirely confined type of a known reinforced concrete frame, node to which a plurality of beams lead. It may be useful to specify that for economy of drawing Figs. 1-6 illustrate only one node N of the frame to which the equipment 1 is to be applied. Each time it is necessary to make a node N as described above safe from a structural point of view, it must be understood how many faces action can be taken on, i.e., how many faces are free from the beams leading to the node N. Generally, the faces of a node on which it is possible to take action will be two and adjacent if the pillar is angled, and two and opposite if this is an intermediate node in which a pillar is convergent for two aligned beams arranged on opposite sides of the same pillar, or one if it is an intermediate node for converging pillar with three beams converging on the node leaving one unconfined face.

[0026] In this case, the beams and the intermediate pillar are delimited by coplanar faces that contribute to define together a portion of a façade of the building.

[0027] With reference to Figs. 1-8, the node N is arranged at the intersection of three beams T1, T2 and T3, where the beams T2 and T3 are aligned and the beam T1 is orthogonal to the first two. The node N, and naturally the three beams T1, T2 and T3, are carried by a pillar P, where both these beams and the pillar P are longitudinally reinforced with bars I. Therefore, the node N is delimited by a first external face FE that is in fact a portion of one of the facades of the building.

[0028] With reference to Fig. 1bis, a substantially prismatic recess R can be obtained in the first face FE, arranged between the beams T2 and T3. This recess R is delimited peripherally by a substantially parallelepiped concave surface S that has a first perimeter P1 having a given shape and at the bottom is delimited by a second internal face FI. This second face FI is transverse to the longitudinal direction associated with the beam T1; therefore, it can be said that it is arranged on the projection of the same beam T1 according to its longitudinal direction and parallel to the first face FE, as can be seen in Figs. 1bis, 2 and 3.

[0029] The equipment 1 comprises a flat plate 10 dimensioned to engage the recess R. In this regard, the plate 10 has a given thickness and is peripherally delimited by a second perimeter P2 having a geometrical shape similar to said first perimeter P1. In particular, with reference to Figs. 1-2, the plate 10 has a substantially parallelepiped shape is provided with a plurality of through holes 12 and with elongated lightening slots 16. If considered appropriate, as shown in Fig. 2, the vertices of the plate 10 can be bevelled, without this detail being considered essential for the implementation of the present invention.

[0030] The plate 10 can be made of steel, aluminium alloy or another material capable of combining strength and elasticity to accommodate bending and torsion without losing its original shape. For this reason, the plate can also be made by superimposing a plurality of carbon fibre panels based on the strength required to be given to the product.

[0031] The equipment 1 further comprises a plurality of attachment members 20 visible in Figs. 1bis, 3 and 4, suitable to connect the plate 10 to the second face FI.

[0032] With reference to Figs. 1bis, 3 and 4, the second face FI is distant from said first face FE by a length that exceeds the given thickness of the plate 10. The node N has a plurality of holes FF made in the second face FI and arranged at the holes 12 of the plate 10 when, in use, it is arranged internally to the recess R. Each attachment member 20 comprises a screw 22 suitable to engage the node N in a respective hole FF so as to stably couple the plate 10 to the node N internally to the recess R.

[0033] When obtaining the recess R and making the holes FF this might cause local destruction of the protection provided by the concrete cover to the reinforcement bars I, which of course must be restored. For this reason, with reference to Figs. 1bis-4, the equipment comprises a coating layer 24 of concrete having the function of a concrete cover that engages the recess R in external contact with the plate 10 and can fill the free holes 12

and the slots 16 to improve transverse anchoring of the plate 10. The layer 24 is dimensioned in thickness so that when the node N is made safe, as in Figs. 2-4, a third external flat face 240 of the layer 24 is coplanar to the first external face FE of the node N.

[0034] The use of the equipment 1 is easily understood from the description above and does not require further explanations. Furthermore, it may be useful to specify that in order to apply the equipment 1 to the node N of Figs. 1-4 as described above, it is necessary to obtain the recess R in the respective external face FE. In this case, the recess R is sufficiently deep to house the plate 10 and to leave space in the recess R for the layer 24. It may be useful to specify that before engaging the recess R with the plate 10 it will be necessary to drill the second face FI with the plurality of holes FF that may advantageously be made at some of the holes 12 of the plate 10 chosen based on the arrangement of the bars I. After having made the holes FF and placed the plate 10 internally to the recess R, the plate 10 can be attached to the first face FE through the screws 22 and then the layer 24 of concrete having the function of a concrete cover can be applied externally, thus protecting any bare bars I, the plate 10 and the head of the screws 12; subsequently, the layer 24 of concrete will be levelled externally so that the third face 240 is coplanar with the first face FE of the node N.

[0035] Finally, it is clear that modifications and variations may be made to the equipment 1 described and illustrated herein, without departing from the scope of protection of the present invention.

[0036] For example, with reference to Figs. 6 and 8, if the first face FE is angled, then the recess R is consequently also angled and has two adjacent transverse faces. To guarantee complete adhesion of the plate 10 to the second angled face FI of the recess R, the plate 10 is replaced by a plate 10' that has an edge and is shaped at an angle and the connection between the plate 10 and the recess R is naturally guaranteed by a plurality of screws 22 for each of the flat and angled portions 100 and 100' of the plate 10' .

[0037] Moreover, in the case in which the second face FI defining the bottom of the recess R is not completely flat, and parallel to the first external face FE, it might be useful to modify the recess R as illustrated in Figs. 9-11. In particular, with particular reference to Fig. 9, the recess R must be sufficiently deep to allow the creation of a concrete substrate 26 that will be made as flat as possible, to then place thereon the plate 10 acting as gap between the plate 10 and the second face FI. Furthermore, to maximize the probability that also in this situation the plate 10 is arranged parallel to the first external face FE of the node N, and hence transverse to the beam T1 (which leads to the node N on the side opposite the recess R), it is useful to provide for the use of an adjustment device 30 for adjusting the spatial inclination of the plate 10 relative to the first face FE, better visible in Figs. 9 and 10. This adjustment device 30 comprises a plurality of ferrules 32, in particular at least three, each of which is housed in the manner of a screw in the plate 10 preferably in holes made in proximity to the related vertices. By rotating each ferrule 32 housed in the manner of a screw in the plate 10 about its axis, this determines a greater or lesser free extension of the ferrule relative to the plate 10, and hence a greater or lesser distance between the corresponding portion of the face of the plate 10 facing the second face FI and this second face FI. This allows the plate 10 to be oriented at will and, consequently, made parallel to the first external face FE of the node N so that the external face of the plate 10 is covered with a layer 24 having a constant thickness after the node N has been made safe through the use of the equipment 1, as can be seen in Fig. 11. It should be pointed out that in this figure the ferrules 32 have been sheared flush with the external face of the plate 10 to leave them in place even when the concrete of the layer 24 has solidified.

[0038] Based on the description above, it is easily understood how the use of the equipment 1 in the two modes described with reference to Figs. 1-5, 6 and 9-11 allows nodes of a not entirely confined type of reinforced concrete frames to be made safe through the tensile action exerted by the screws 12 that engage the node N between the respective bars I of the beams T1, T2, T3 and of the pillar P as if they were anchor bolts.

[0039] Furthermore, it may be useful to specify that the plate 10 could also be applied directly to the first face FE of the node N to be made seismically safe both when this first face FE is flat and when it is angled. Naturally, in this second case, the plate 10 must have an identical angle to that of the first angled face FE; in any case, the external surface/surfaces of the first angled face FE must be flat or made flat before application of the plate 10.

[0040] In the claims, any reference signs in parentheses must not be interpreted as a limitation of the claim. The word "comprising" does not exclude the presence of other elements or steps besides those listed in a claim. Moreover, the term "one", as used in this context, is defined as one or more than one. Moreover, the use of introductory expressions such as "at least one" and "one or more" in the claims must not be interpreted in the sense that the introduction of another claim element identified using the indefinite articles "a" or "an" limits any particular claim in which this claim element appears singularly, even when this claim comprises the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an". This is also the case for the use of definite articles. Unless otherwise established, terms such as "first" and "second" are used to arbitrarily distinguish between the elements that these terms describe. Therefore, these terms are not necessarily destined to indicate the temporal or other type of priority of these elements. The simple fact that some measures are set forth in mutually different claims does not indicate that a combination of these measures cannot be used advantageously.

Claims

1. Equipment (1) for reinforcing a node (N) of a not entirely confined type of a reinforced concrete frame; said node (N) being arranged at the intersection of at least one beam (T1, T2, T3) and one pillar (P) reinforced longitudinally and being delimited externally by a first external face (FE) in which a substantially prismatic recess (R) is obtained delimited peripherally by a surface (S) that has a first perimeter (P1) having a given shape and at the bottom by a second internal face (FI); said equipment (1) comprising a plate (10) peripherally delimited by a second perimeter (P2) having a geometrically similar shape to said first perimeter (P1) and having a given thickness; attachment means (20) being provided for connecting said plate (10) to said second face (FI); **characterized in that** it comprises adjustment means (30) for adjusting the position of said plate (10) relative to said second face (FI).

2. The equipment according to claim 1, **characterized in that** said second face (FI) is distant from said first face (FE) by a length that exceeds said given thickness of said plate (10); said node (N) having a plurality of holes (FF) made in said second face (FI); said attachment means (20) comprising a plurality of screws (22) each for engaging said node (N) in a respective said hole (FF) so as to couple said plate (10) to said node (N) internally to said recess (R).

3. The equipment according to claim 1 or 2, **characterized in that** it comprises a coating layer (24) of concrete having the function of a concrete cover that engages said recess (R) in external contact with said plate (10).

4. The equipment according to claim 3, **characterized in that** said layer (24) is externally delimited by a third face (240) coplanar to said first external face (FE).

5. The equipment according to claim 3, **characterized in that** said first face (FE) is flat; said plate (10) is flat.

6. The equipment according to claim 3, **characterized in that** said first face (FE) is angled; said plate (10) is angled.

7. The equipment according to any one of the preceding claims, **characterized in that** said adjustment means (30) comprise at least three ferrules (32) screw-adjustable in height which transversely engage said plate (10).

8. The equipment according to any one of the preceding claims, **characterized in that** said plate (10) has lightening slots (16) engageable by said coating layer (24).

9. A method for reinforcing a node (N) of a not entirely confined type of a reinforced concrete frame; said node (N) being arranged at the intersection of at least two longitudinally reinforced beams (T1, T2, T3) and a pillar (P) and being delimited externally by a first external face (FE); said method being **characterized in that** it comprises a step for obtaining a recess (R) in said node (N) as a projection of a first beam (T1) of said at least two beams (T1, T2, T3); said recess (R) being substantially prismatic and delimited peripherally by a surface (S) that has a first perimeter (P1) having a given shape and at the bottom by a second internal face (FI); a step of housing a plate (10) delimited by a second perimeter (P2) having a geometrically similar shape to said first perimeter (P1) and having a given thickness within said recess (R); a step of attaching said plate (10) to said second face (FI).

10. The method according to claim 9, **characterized in that** it comprises a step for obtaining a plurality of holes (FF) in said second face (FI); a step of engaging each hole of said plurality of holes (FF) with a screw (22) of said plurality of screws (22) so as to couple said plate (10) to said node (N) internally to said recess (R).

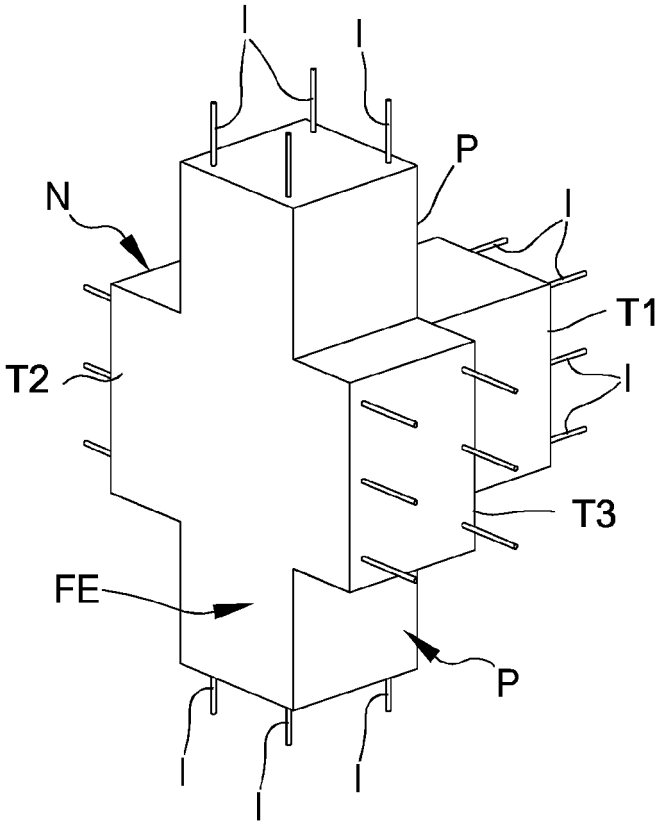
11. The method according to claim 10, **characterized in that** it comprises a step of covering said plate (10) with a coating layer (24) of concrete having the function of a concrete cover.

12. The method according to claim 10 or 11, **characterized in that** said first face (FE) is flat; said plate (10) being flat.

13. The method according to claim 10 or 11, **characterized in that** said first face (FE) is angled; said plate (10) being angled.

14. The method according to claim 12 or 13, **characterized in that** it comprises a step of adjusting (30) the position of said plate (10) relative to said second face (FI) by screw adjustment means (30).

Fig.1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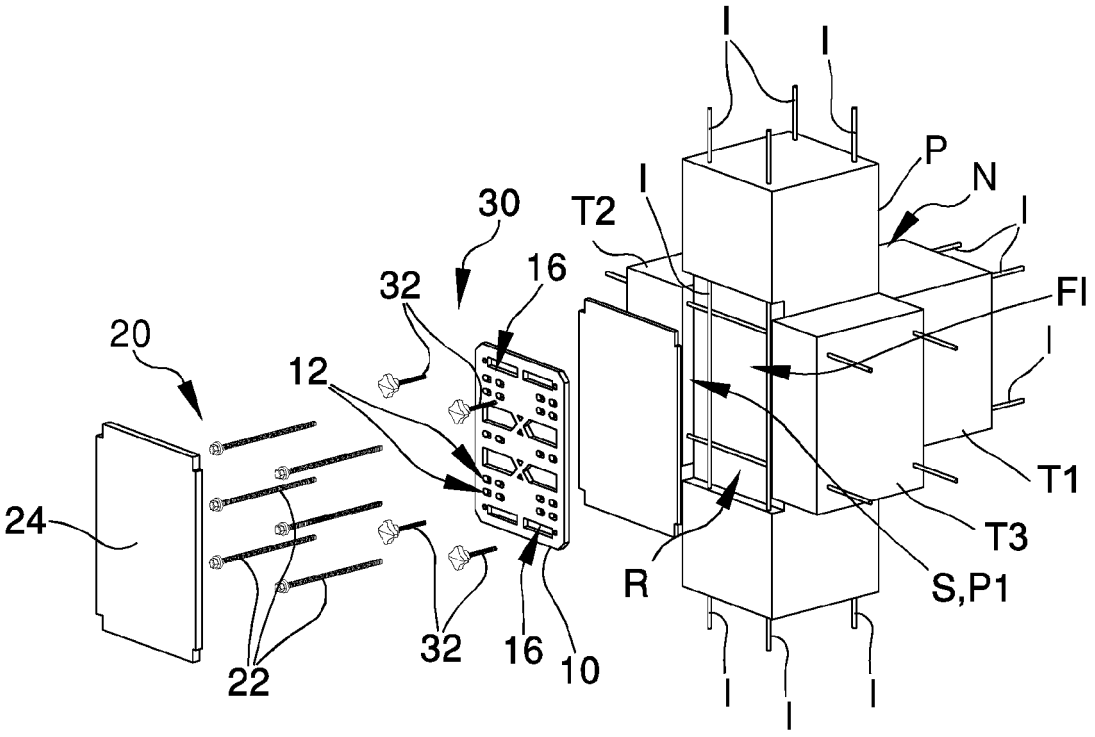
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Fig.9

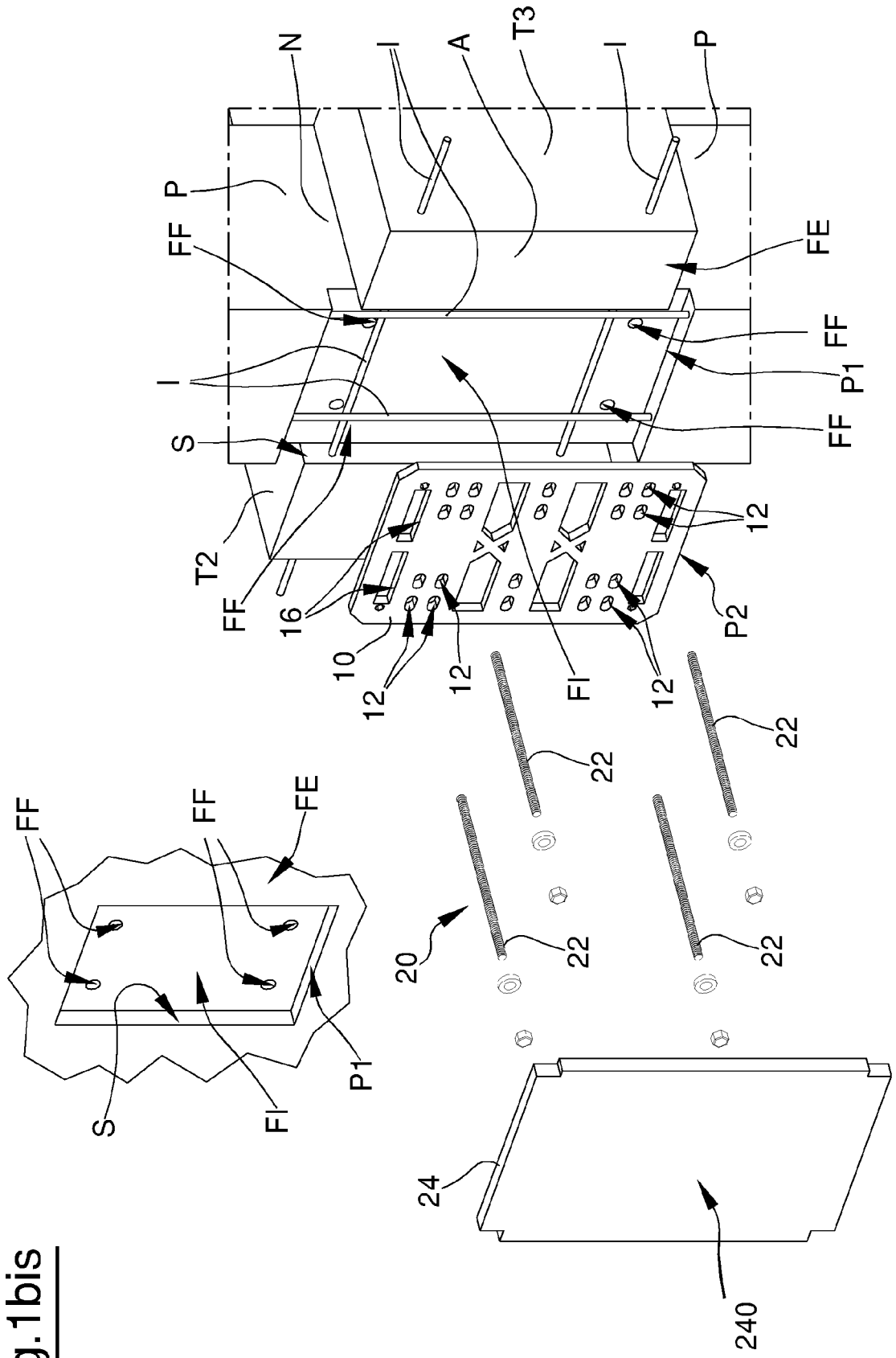
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Fig.1bis

Fig.2

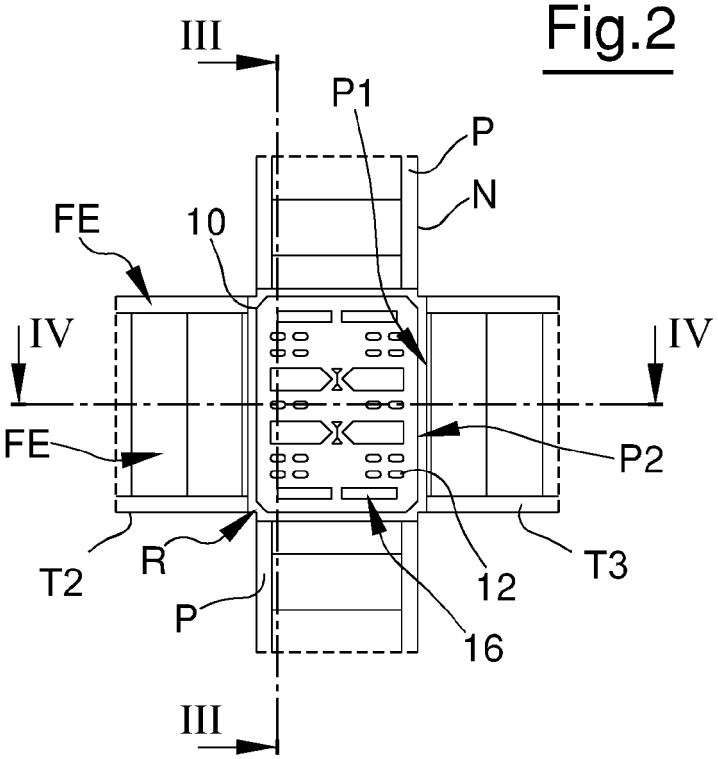


Fig.3

Sect. III-III

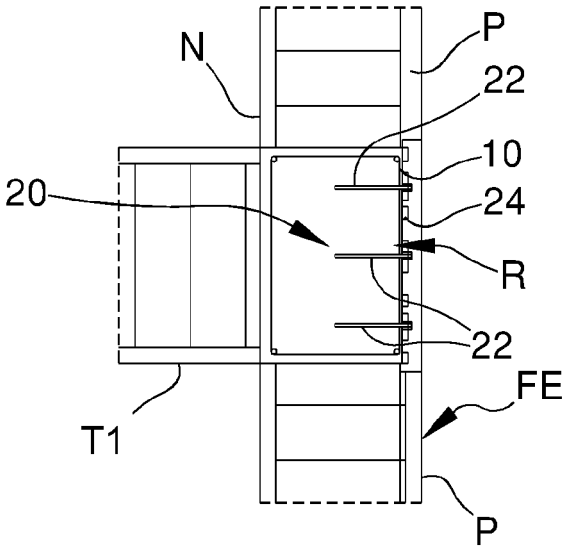
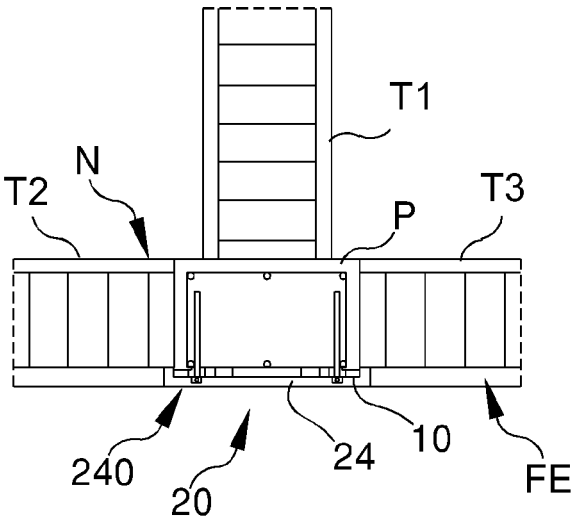


Fig.4

Sect. IV-IV



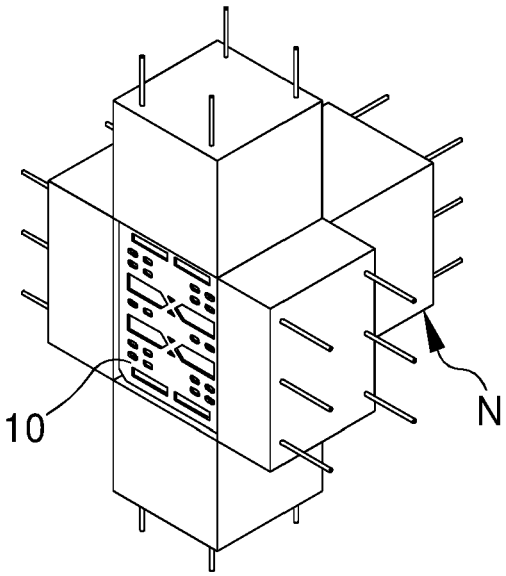


Fig.5

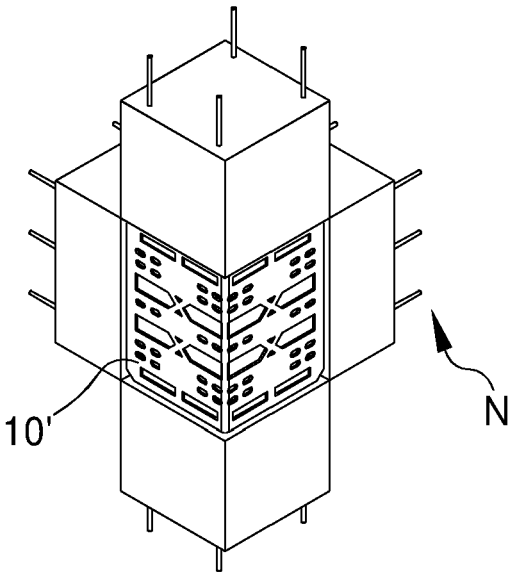


Fig.6

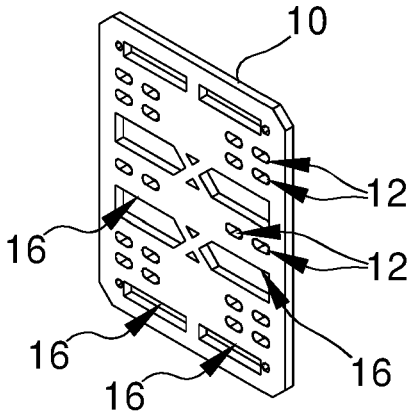


Fig.7

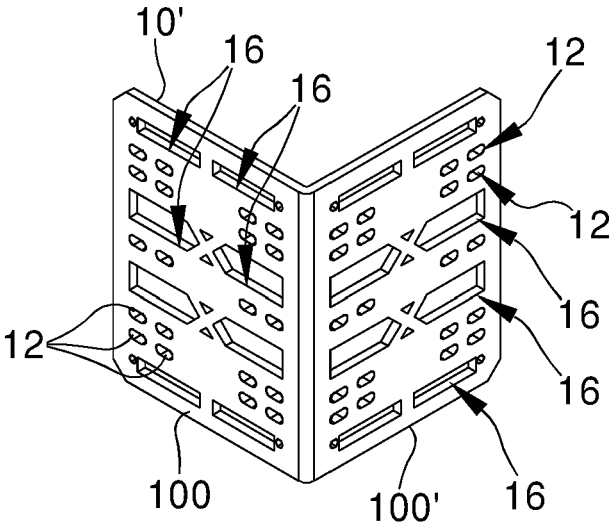


Fig.8

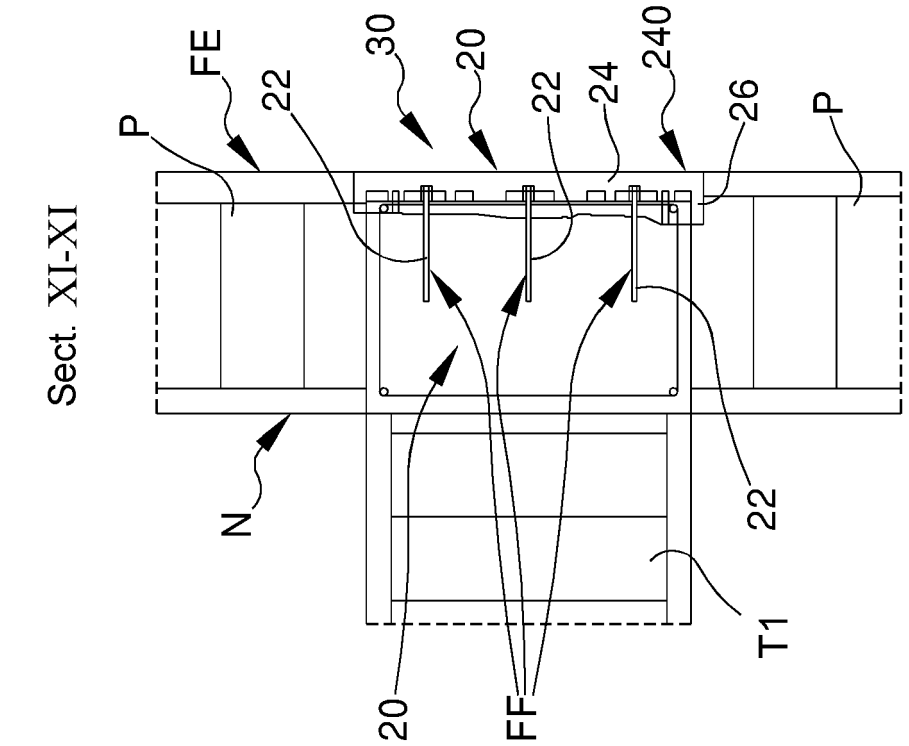

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Fig.11

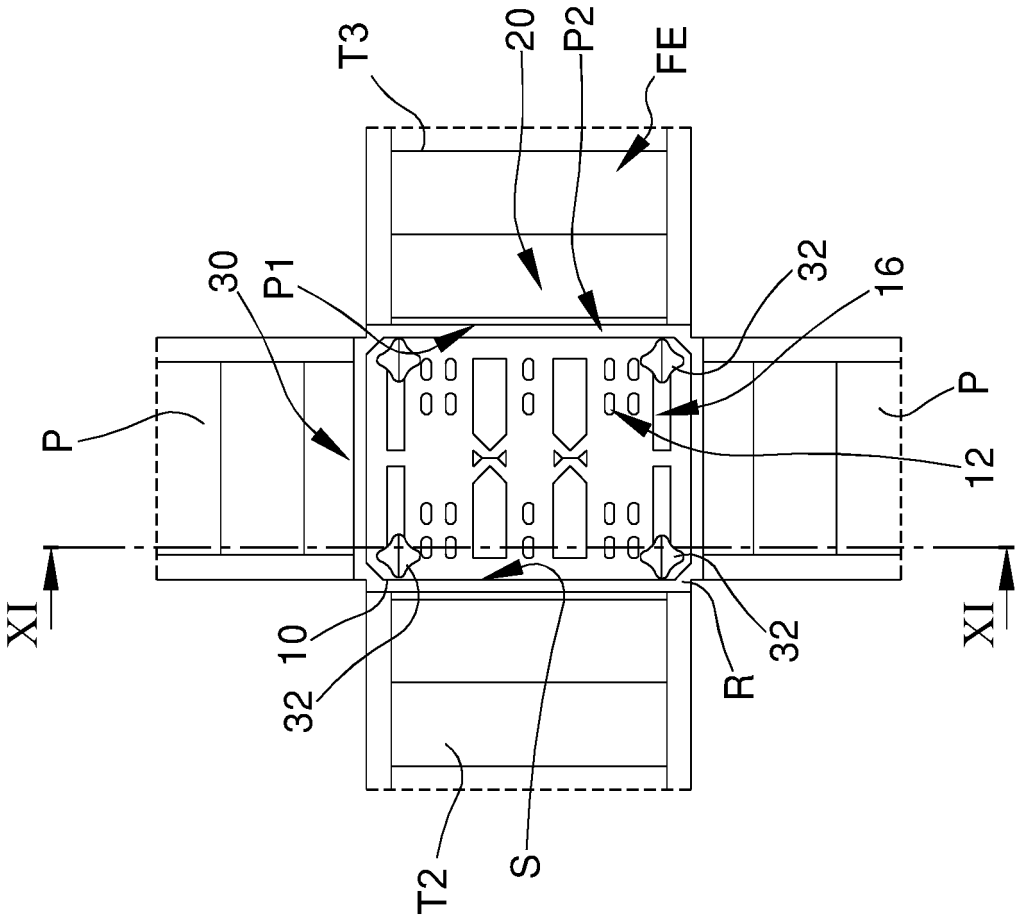
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Fig.10

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 0656

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	IT BO20 120 564 A1 (GALLUCCIO ANTON MASSIMO) 17 April 2014 (2014-04-17) * page 11, line 15 - page 16, line 10; figures 1-6 *	1-14	INV. E04G23/02 E04B1/26 E04H9/02
Y	KR 101 999 527 B1 (YOON CHAE HO [KR]) 12 July 2019 (2019-07-12) * paragraph [0022] - paragraph [0047]; figures 1-7 *	1-14	
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E04G
E04H
E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 September 2023	Manera, Marco

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