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(54) Title: VEHICLE HAVING A FRAME PROVIDED WITH A SUPPORTING STRUCTURE FOR AUXILIARY UNITS, IN PARTICULAR GAS TANKS OR ELECTRIC BATTERIES

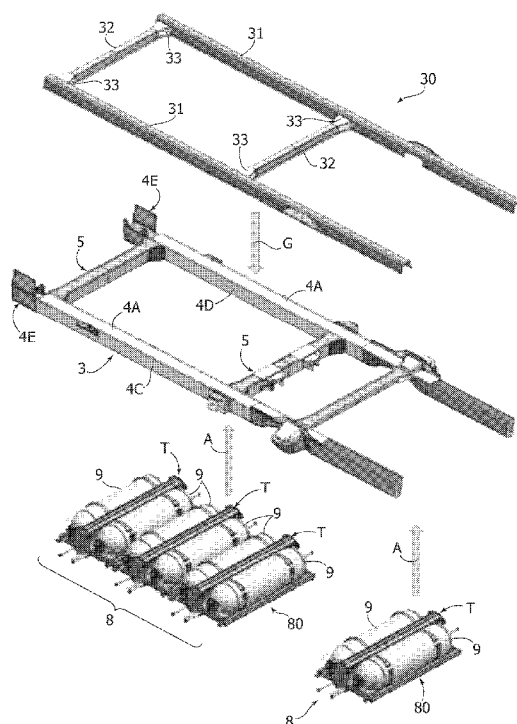


FIG. 3

(57) Abstract: A light duty vehicle comprises a vehicle frame (3), including a pair of longitudinal beams (4) connected to each other by a plurality of cross-members (5) and a cabin frame (2), comprising a pair of longitudinal beams (7) rigidly connected to the front ends of the longitudinal beams (4) of the vehicle frame (3). The vehicle further comprises a supporting structure (8) for auxiliary units (9), such as gaseous fuel tanks or electric batteries, this supporting structure being carried by the vehicle frame (3). The supporting structure (8) for the auxiliary units (9) comprises an auxiliary frame (80) which extends between the longitudinal beams (4) of the vehicle frame (3) and has at least two connection plates (P) arranged in vertical planes parallel to the longitudinal direction of the vehicle frame (3) and which are in contact with the mutually facing inner lateral walls (4D) of the longitudinal beams (4) of the vehicle frame (3).



KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

are rigidly connected to these longitudinal beams (4). The auxiliary frame (80) fulfills a structural function equivalent to the structural function of one or more cross-members (5) at an area of the vehicle frame (3) where the cross-members (5) are omitted.

“Vehicle having a frame provided with a supporting structure for auxiliary units, in particular gas tanks or electric batteries”

Field of the invention

5 The present invention relates to vehicles, and in particular to light duty vehicles of the type comprising:

- a vehicle frame (3), comprising a pair of longitudinal beams (4) connected to each other by a plurality of cross-members (5),

- a cabin frame (2), comprising a pair of longitudinal beams (7) rigidly connected to the front ends of the longitudinal beams (4) of the vehicle frame (3),

- at least one supporting structure (8) for auxiliary units (9) such as gaseous fuel tanks or electric batteries, carried by the vehicle frame (3),

- said vehicle being characterized in that:

- 15 - said supporting structure (8) for supporting the auxiliary units (9) comprises an auxiliary frame (80) which extends between the longitudinal beams (4) of the vehicle frame (3) and has at least two connection plates (P) arranged in vertical planes parallel to the longitudinal direction of the vehicle (3),

- 20 - said connection plates (P) of the auxiliary frame (80) are in contact with mutually facing inner lateral walls (4D) of said longitudinal beams (4) of the vehicle frame (3) and are rigidly connected to said longitudinal beams (4) of the vehicle frame (3),

so that said auxiliary frame (80) fulfills a structural function equivalent to the structural function of one or more of said cross-members (5) at an area of the vehicle frame (3) where said cross-members (5) are not provided or are omitted for leaving space for the auxiliary frame, and are therefore replaced by the latter,

Prior art

30 A vehicle of the above indicated type is known from DE 20 2010 008375 U1. Similar solutions are also known from EP 3 296 186 A1 and US 2005/062251 A1.

Object of the invention

35 The object of the present invention is that of providing a vehicle of the above indicated type having an extremely resistant and reliable

structure which at the same time has a simple construction and implies relatively reduced production costs.

Summary of the invention

In view of achieving this object, the invention provides a vehicle
5 having the features which have been indicated in the foregoing and further characterized in that the above-mentioned connection plates of the auxiliary frame which are arranged at vertical planes parallel to the longitudinal direction of the vehicle frame are provided with flanges which project therefrom and constitute abutment elements which are in abutting
10 contact with the lower walls of the two longitudinal beams of the vehicle frame, and In that the auxiliary frame has a quadrangular configuration, including two longitudinal arms and two transverse arms rigidly connected to each other and further comprising at least one cross-member which connects the longitudinal arms to each other and has ends carrying said
15 connection plates arranged at vertical planes parallel to the longitudinal direction of the vehicle frame.

In the case of a preferred embodiment, said cross-member of the auxiliary frame is in form of a hollow beam, with an upper wall, a lower wall, two lateral walls and end surfaces to which said connection plates
20 are rigidly connected. The connection plates have portions projecting with respect to the cross-section of the cross-member, which are provided with holes or threaded bushes for engagement of screws for a rigid connection to the longitudinal beams of the vehicle frame.

A specific application of the above-described structure is that of the
25 housing of a plurality of tanks for gaseous fuel having a substantially cylindrical shape. In the case of this application, said at least one cross-member of the auxiliary frame has concave lateral walls configured for defining a seat for respective gas tanks arranged in a horizontal position, with their axes arranged transversely to the longitudinal direction of the
30 vehicle frame. In this case, to each lateral wall of the cross-member of the auxiliary frame there are associated belts for securing the gas tanks to the auxiliary frame.

According to a further preferred feature, the vehicle further comprises a counter-frame comprising a pair of longitudinal beams
35 extending above the longitudinal beams of the vehicle frame and rigidly

connected thereto, and a plurality of cross-members which connect the longitudinal beams of the counter-frame to each other, said counter-frame acting as a spacer element in order to avoid a direct contact of the gas tanks with a floor panel of the vehicle.

5 Due to the above mentioned features, the auxiliary frame ensures a stable support for the auxiliary units, in particular for the tanks of gaseous fuel. At the same time, the auxiliary frame is integrated within the vehicle frame so as to act as a structural element of the frame, adapted to give a contribution to the resistance of the frame against deformation. Therefore,
10 at the area where the auxiliary frame is integrated within the vehicle frame, the latter does not have cross-members connecting the longitudinal beams, since the function of these cross-members is fulfilled by said auxiliary frame, which acts as a structural element adapted to counteract deformations, in particular twisting deformations, of the vehicle frame,
15 similarly to, or even better than, what is normally achieved with the cross-members which connect the longitudinal beams of the vehicle frame to each other.

A further advantage of the above-described structure lies in that assembling of the vehicle can be performed with extremely simple and
20 quick operations. In the case for example of tanks for gaseous fuel, the tanks can be preassembled on the auxiliary frame, after which the unit constituted by the auxiliary frame with the fuel tanks preliminarily assembled thereon is mounted on the vehicle frame, by moving the unit towards the vehicle frame from below, until to obtain an abutment contact
25 of the above-mentioned flanges acting as abutment elements, against the lower walls of the longitudinal beams of the frame. In this condition the auxiliary frame is arranged between the two longitudinal beams, with the above-mentioned connection plates arranged at the ends of the transverse elements of the auxiliary frame in contact with the facing inner
30 walls of the longitudinal beams. In this condition, the auxiliary frame carrying the gas tanks can be secured to the longitudinal beams of the vehicle frame.

The structure of the vehicle can be also provided with more than one auxiliary frame, each auxiliary frame being arranged with one or more
35 auxiliary units, such as gas tanks or electric batteries.

Detailed description of the invention

Further features and advantages of the invention will become apparent from the description which follows with reference to the annexed drawings, given purely by way of non-limiting example, in which:

5 - figure 1 is an exploded perspective view of the supporting structure of a light duty vehicle, including a cabin frame and a vehicle frame,

10 - figure 2 shows the vehicle frame of figure 1 transformed according to the teachings of the present invention by replacing some cross-members of the vehicle frame with assemblies supporting auxiliary units, in the illustrated example gas tanks,

 - figure 3 is an exploded perspective view of the structure of figure 2,

15 - figure 4 is a perspective view of a detail of figure 3 at an enlarged scale, and

 - figure 5 is a perspective view at an enlarged scale of the auxiliary frame forming part of the assembly of figure 4.

20 In figure 1, reference numeral 1 generally designates the supporting structure of a light duty vehicle, including a cabin frame 2 and a vehicle frame 3. A vehicle frame 3 comprises a pair of longitudinal beams 4 connected to each other by a plurality of cross-members 5.

25 In the case of the present invention, the longitudinal beams 4 of the vehicle frame 3 have a hollow structure of welded sheet metal, with an upper wall 4A, a lower wall 4B, two outer lateral walls 4C and two inner lateral walls 4D. At least some of the cross-members 5 also have a hollow structure of welded sheet metal, including an upper wall, a lower wall and two lateral walls. In the case of the illustrated example, the ends of the cross-members 5 are rigidly connected to the longitudinal beams 4 of the vehicle frame 3 by means of intermediate supports 6 which are welded
30 both to the cross-members 5 and the longitudinal beams 4. The cabin frame 2 can be made in any known way, but in any case comprises a pair of longitudinal beams 7 which are rigidly connected, for example by welding, to the front ends of the longitudinal beams 4 of the vehicle frame 3. To this end, in the illustrated example, the front ends of the longitudinal
35 beams have coupling portions 4E having a U-shape which are engaged

around the rear ends of the longitudinal beams 7 of the cabin frame 2.

According to the present invention, some of the cross-members 5 of the vehicle frame 3 shown in figure 1 are replaced by assemblies 8 (see for example figure 3) for supporting tanks 9 for gaseous fuel (in particular CNG), which are in the form of substantially cylindrical containers, arranged in a horizontal position, with their axis directed transversely with respect to the longitudinal direction of the vehicle frame 3.

As shown in figure 3, the vehicle frame 3 is substantially identical to the frame 3 which has been described with reference to figure 1, except for that cross-members 5 are omitted at the areas where the assemblies 8 must be mounted.

In figures 2, 3, the parts in common to those of figure 1 are designated by the same reference numerals. In the example illustrated herein, the vehicle frame is provided with a first assembly 8 for supporting three pairs of tanks 9, and a further assembly 8 for supporting a single pair of tanks 9. It is clearly apparent that this arrangement is illustrated herein purely by way of non-limiting example. A vehicle frame can be indeed provided with any number of assemblies 8 (also a single assembly) and each assembly 8 can be provided for supporting any number of tanks 9.

Each assembly 8 includes an auxiliary frame 80 which supports the tanks 9 and is rigidly connected to the vehicle frame 3.

Figure 5 shows a perspective view of the frame 80 of an assembly 8 which supports a pair of tanks 9. In this embodiment, the auxiliary frame 80 has a quadrangular configuration, with two longitudinal arms 80L and two transverse arms 80T rigidly connected to each other. In the illustrated example, each of these arms is in the form of a metal bar with a square cross-section, so as to define a very rigid frame. Also with reference to figure 5, the central portions of the two longitudinal arms 80L are connected to each other by a cross-member T which in the illustrated example is in the form of a hollow beam of welded sheet metal. The cross-member T has an upper wall T1, a lower wall T2 and two lateral walls T3. To the end surfaces of the cross-members T there are welded two connection plates P arranged at a vertical planes parallel to the longitudinal direction of the vehicle frame and having lugs projecting from

the cross-section of the cross-members T, which are provided with holes or threaded bushes B, for engagement of screws for a rigid connection to the longitudinal beams 4 of the vehicle frame 3. In the assembled condition (figure 2) the connection plates P are in contact with the inner
5 walls 4D of the longitudinal beam 4 of the vehicle frame 3 which are facing towards each other.

As diagrammatically shown by the arrows A in figure 3, the assemblies 8 are assembled from below on the vehicle frame 3.

Two flanges F axially project outwardly from the connection plates
10 P of each cross-member T, these flanges acting as abutment elements adapted to engage the lower walls 4B of the two longitudinal beams 4 of the vehicle frame 3. In the specific example illustrated herein, each flange F is constituted by a flat portion of an L-shaped element welded to the respective plate P.

15 With reference to figure 3, in the case of the example illustrated herein, the vehicle frame 3 is provided, as indicated in the foregoing, both with an assembly 8 carrying a single pair of tanks 9 and with an assembly 8 carrying three pairs of tanks 9. This latter assembly also has an auxiliary frame 80 similar to that which has been described above with reference to
20 figure 5, except for that the longitudinal beams 80L have a longer extension and are connected to each other by many cross-members T. It is also absolutely possible, in place of a single frame 80 carrying the three pairs of tanks 9, to provide three frames 80 of the type shown in figure 5, located at positions adjacent to each other.

25 An important feature of the present invention lies in that, due to the structure and the arrangement which have been described above, each auxiliary frame 80 fulfills a structural strengthening function for the vehicle frame 3 which is absolutely similar to, or even more effective than, the structural function fulfilled by the cross-members 5 of the vehicle frame.
30 As already indicated, in the area where the assemblies are provided, the cross-members 5 are omitted, but each auxiliary frame 80 is able to fulfill the same function, due to the rigid configuration of this frame and due to the connection which has been described above between the ends of the cross-members T and the longitudinal beams 4. In particular, the auxiliary
35 frames 80 contribute to counteract the deformations of the frame 3 and

above all they prevent undesired twisting deformations of this frame.

In this manner, the auxiliary frames 80 carrying the gas tanks 9 also fulfill a safety function, by absorbing impact energy in the case of a vehicle collision.

5 With specific reference to the example in which each assembly 8 carries gas tanks having the cylindrical configuration which has been described above, the lateral walls T3 of each beam T have a concave shape with a curved profile, so as to define a seat for the body of the adjacent tank 9. Furthermore, each wall T3 has slots 10 through which
10 securing metal belts 11 (figure 4) can be engaged, for securing the tanks 9 to the frames 80.

 In the case of the specific example illustrated herein, to the vehicle frame 3 there is associated also a counter-frame 30, comprising a pair of longitudinal beams 31 connected to each other by cross-members 32. The
15 longitudinal beams 31 are arranged above and along the longitudinal beam 4 of the vehicle frame 3 and are rigidly connected thereto, for example by means of screws or by welding, in the case of the illustrated example, also the cross-members 32 are connected to the longitudinal beams 31 with the interposition of intermediate supports 33, each of which
20 is welded both to the longitudinal beams and to the cross-members 32.

 The counter-frame 30 is assembled from above (see arrow G in figure 3) on the vehicle frame 3. As shown in figure 2, in the assembled condition, the counter-frame 3 acts as a spacer adapted to prevent a direct contact of the floor panel of the vehicle with the gas tanks 9.

25 As indicated in the foregoing, the invention is applicable also to the support of auxiliary units different from gas tanks, such as to the support of electric batteries.

 Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may widely vary with respect
30 to what has been described and shown purely by way of example, without departing from the scope of the present invention.

CLAIMS

1. Light duty vehicle, comprising:

- a vehicle frame (3), comprising a pair of longitudinal beams (4)
5 connected to each other by a plurality of cross-members (5),
- a cabin frame (2), comprising a pair of longitudinal beams (7)
rigidly connected to the front ends of the longitudinal beams (4) of the
vehicle frame (3),
- at least one supporting structure (8) for auxiliary units (9) such as
10 gaseous fuel tanks or electric batteries, carried by the vehicle frame (3),
- said vehicle being characterized in that:
 - said supporting structure (8) for supporting the auxiliary units (9)
comprises an auxiliary frame (80) which extends between the longitudinal
beams (4) of the vehicle frame (3) and has at least two connection plates
15 (P) arranged in vertical planes parallel to the longitudinal direction of the
vehicle (3),
 - said connection plates (P) of the auxiliary frame (80) are in contact
with mutually facing inner lateral walls (4D) of said longitudinal beams (4)
of the vehicle frame (3) and are rigidly connected to said longitudinal
20 beams (4) of the vehicle frame (3),
so that said auxiliary frame (80) fulfills a structural function
equivalent to the structural function of one or more of said cross-members
(5) at an area of the vehicle frame (3) where said cross-members (5) are
not provided or are omitted for leaving space for the auxiliary frame, and
25 are therefore replaced by the latter,
characterized in that said end plates (P) of the auxiliary frame (80)
are provided with flanges (F) which project from said connection plates (P)
and constitute abutment elements in engagement against lower walls (4B)
of the two longitudinal beams (4) of the vehicle frame (3), and
30 in that the auxiliary frame (80) has a quadrangular configuration
including two longitudinal arms (80) and two transverse arms (80T) rigidly
connected to each other and further comprising at least one cross-
member (T) which connects the longitudinal arms (80L) to each other and
which has its ends carrying said connection plates (P) arranged in vertical
35 planes parallel to the longitudinal direction of the vehicle frame (3).

2. Vehicle according to claim 1, characterized in that said at least one cross-member (T) of the auxiliary frame (80) is in the form of a hollow beam, with an upper wall (T1), a lower wall (T2), two lateral walls (T3) and end surfaces to which said connection plates (P) are rigidly connected.

5 **3.** Vehicle according to claim 2, characterized in that said connection plates (P) have portions projecting outwardly with respect to the cross-section of the cross-member (T) which are provided with holes or threaded bushes (B) for engagement of screws for rigid connection to the longitudinal beams (4) of the vehicle frame (3).

10 **4.** Vehicle according to claim 2, which is for housing a plurality of gaseous fuel tanks (9) having a substantially cylindrical shape, characterized in that said at least one cross-member (T) of the auxiliary frame (80) has concave lateral walls (T3) configured for defining a seat for respective gas tanks (9) arranged in a horizontal position with their axes
15 arranged transversely to the longitudinal direction of the vehicle frame (3), securing belts (11), for securing the tanks (9) to the auxiliary frame (70), being associated to each lateral wall (T3).

5. Vehicle according to claim 4, characterized in that it comprises a counter-frame (30) comprising a pair of longitudinal beams (31) extending
20 above the longitudinal beams (4) of the vehicle frame (3), and rigidly connected thereto, and a plurality of cross-members (32) which connect the longitudinal beams (31) of the counter-frame (30) to each other, said counter-frame (30) acting as a spacer element for avoiding a direct contact of the gas tanks (9) with the vehicle floor panel.

25 **6.** Vehicle according to claim 4, characterized in that it comprises one or more auxiliary frames (80), each auxiliary frame (80) being provided for supporting one or more gas tanks (9).

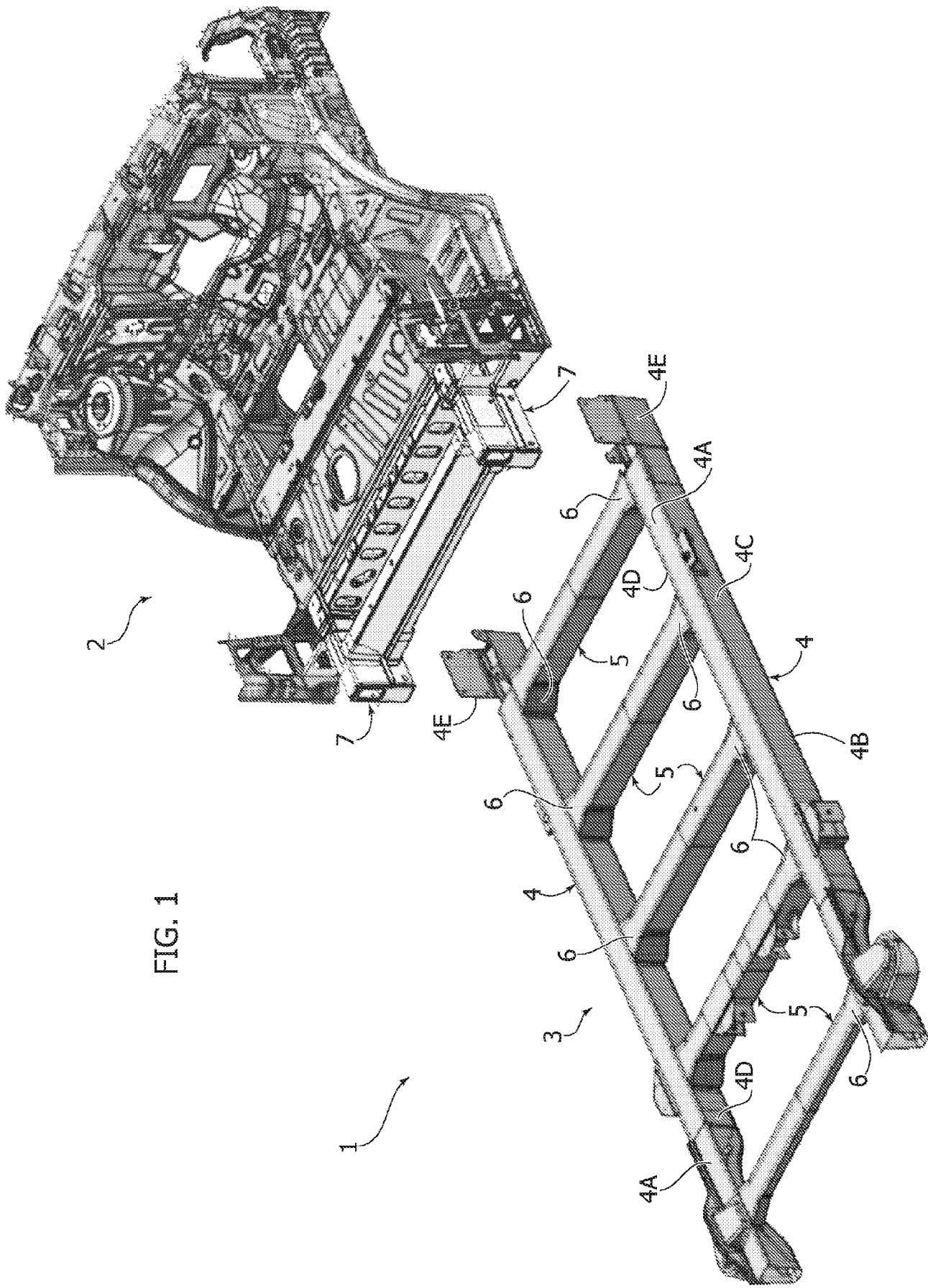


FIG. 1

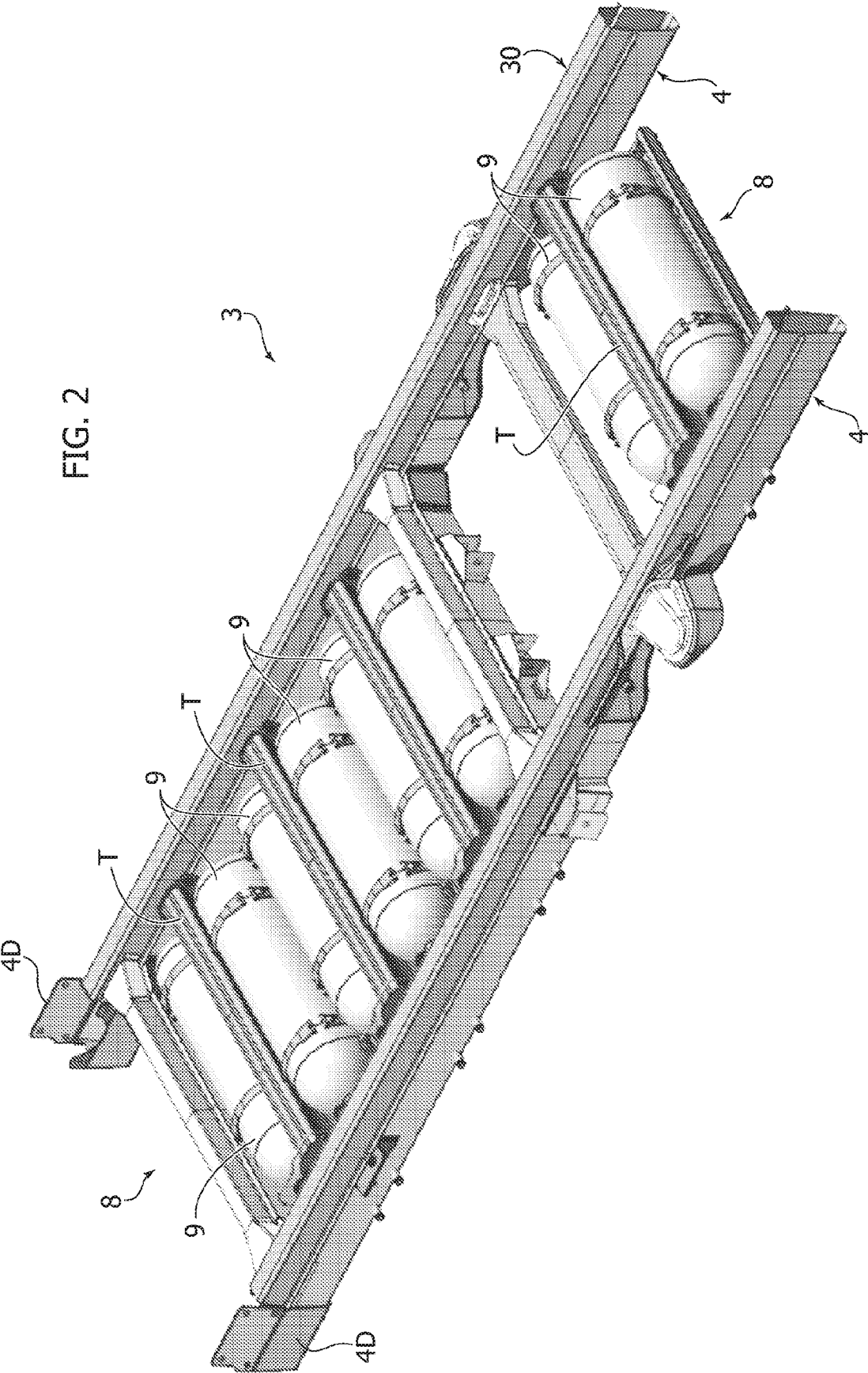


FIG. 3

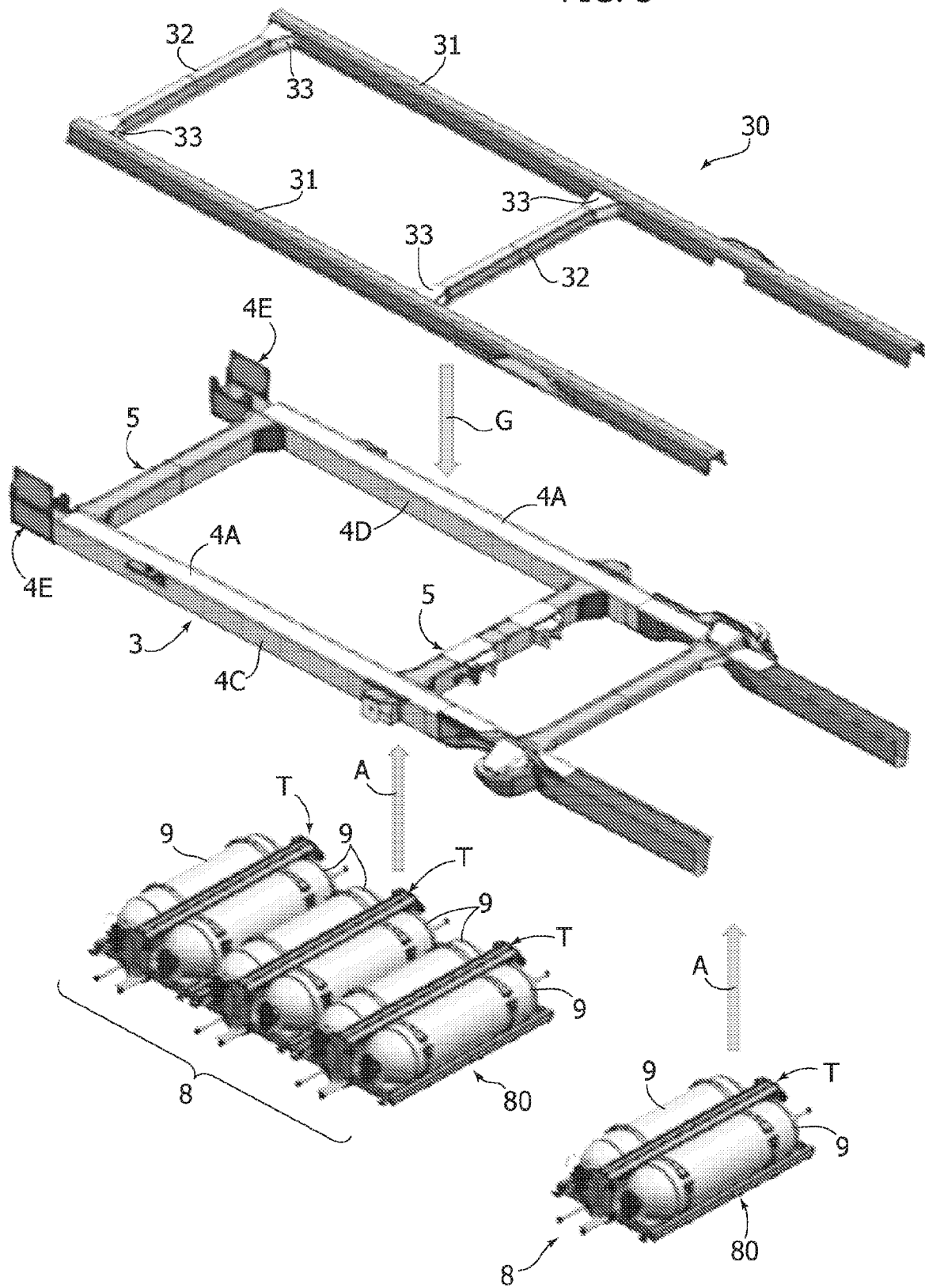


FIG. 4

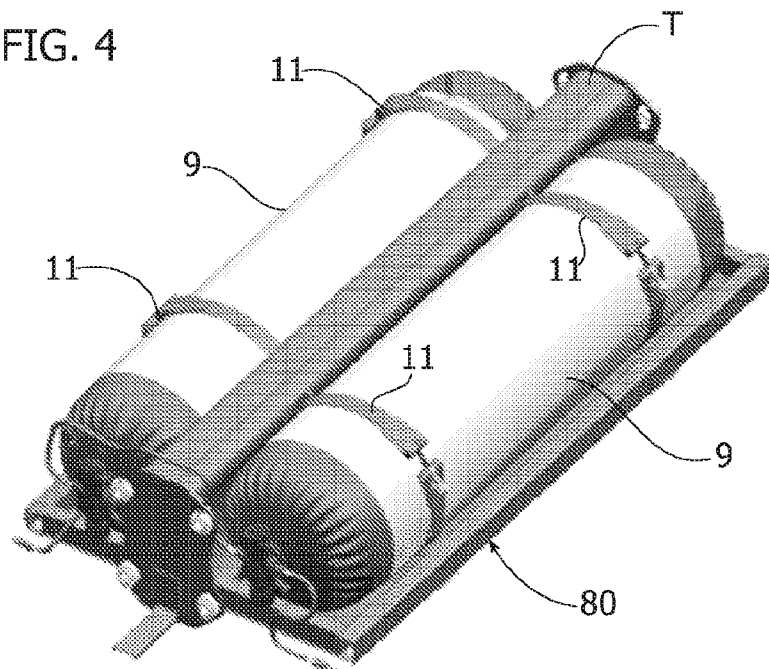
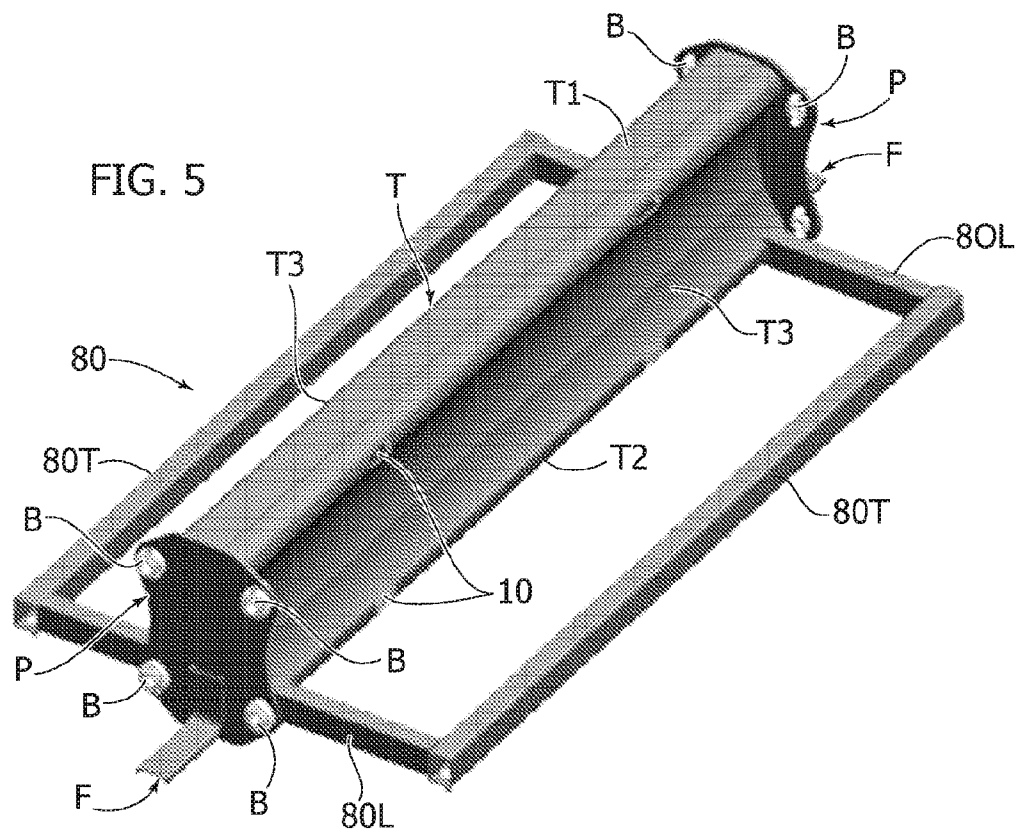


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. B62D21/02 B60K15/03 B60K15/07 B62D21/12
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)
B62D B60K

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	----- EP 3 296 186 A1 (SCHMITZ CARGOBULL AG [DE]) 21 March 2018 (2018-03-21) paragraphs [0034] - [0047] figures 1,2-4	1-5
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

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Date of mailing of the international search report

02/12/2019

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/056857

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2019/056857

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