

MODULE FOR A MODULAR CHASSIS OF A VEHICLE FOR
TRANSPORTING HEAVY LOADS

The present invention relates to a module for a modular
5 chassis of a vehicle for transporting heavy loads.

The invention also relates to a method of mounting such
modules and to a tool for implementing this method.

10 The invention also relates to a modular chassis of a
vehicle for transporting heavy loads having at least
two modules each having at at least one end a joining
surface designed to be able to engage with a
complementary joining surface on the other module.

15 The invention also relates to a port vehicle having at
least one such chassis or at least one such module.

The present invention relates more particularly to the
20 field of heavy handling, and in particular port
handling.

The development of port handling is characterized by
the carrying, on one and the same ship, of ever larger
25 loads. In particular, containers represent the essence
of the commercial payload transported other than in
bulk. The immobilization of a ship at the dock is
expensive and handling means must be suitable for
emptying or introducing as rapidly as possible the
30 entire load that must be carried on or unloaded from a
ship during a stopover.

A port services provider has to adapt his ground
handling fleet to the developing nature of the load.
35 This load generally consists of containers of the
maritime type, the most common ones having a length of
20, 30, 40 or 45 feet, from among the known standards
of 8, 10, 15, 20, 30, 40, 45, 48, 50, 53 or even 60
feet. The volume of a 20-foot container serves nowadays

as a comparative unit of measurement, known as TEU, or twenty-foot equivalent unit.

Special loads can consist of large-dimension assemblies, both in terms of length and of width and height, and in some cases have a very high mass. The services provider does not have special vehicles for every scenario and must envision adapting or/and combining the multipurpose means that he has available.

Telescopic semitrailers, of the low-floor type or having a single beam, are known in the road transport of vehicles or of logs. However, these vehicles are poorly suitable for transporting heavy loads which have very variable centering, such as can be the case with containers, it being possible for a single 20-foot container, according to the standard NG ISO 668, to have a total loaded mass of 34 800 kg. The twinning of such containers is frequent. Cross-bars, known as spreaders, which load/unload docked ships are already capable of transporting at least four containers arranged in two rows of two, which can represent, with small 20-foot containers, a load of around 140 metric tons, this not being compatible with a telescopic system of beams that slide in one another, as are known from the prior art. Specifically, in heavy handling, and in particular in port handling, it is generally desired to arrange the load as close as possible to the ground, for obvious safety reasons, and this stops the chassis or vehicles and trailers from being overdimensioned.

It is also known to form chassis of modular trailers in the manner of engineering military bridges, the modules consisting of prismatic box structures fitted together end to end with a straight edge. Here again, the problem arises of dimensioning for flexural strength, which is often estimated empirically and translates

into large sections, high consumption of steel, a high weight, which harms the energy performance of the tractor-trailer assembly or the train of trailers as the case may be. This design also has the problem of the shear strength of the connection pieces, in particular of the bolts.

The aim of the invention is to enable a port services provider to adapt his ground handling fleet to the nature of the load. The invention also proposes making it easier to maintain his fleet of rolling stock.

To this end, the invention relates to a module for a modular chassis of a vehicle for transporting heavy loads, characterized in that it has at at least one of its ends a joining surface which has at least one oblique support surface that extends between two planar surfaces that are parallel to one another and inclined with respect to said oblique support surface.

The invention also relates to a method of mounting such modules, and a tool for implementing this method.

The invention also relates to a modular chassis of a vehicle for transporting heavy loads, having at least two modules, each having at at least one end a joining surface designed to be able to engage with a complementary joining surface on another module, characterized in that said joining surface and said complementary joining surface form together an assembly having an oblique scarf joint, having an unconnected skew scarf joint or having a key.

According to one feature of the invention, said chassis is dimensioned to carry marine containers of 8, 10, 15, 20, 30, 40, 45, 48, 50, 53 or 60 feet.

The invention also relates to a port vehicle having at least one such chassis or at least one such module.

According to one feature of the invention, this vehicle
5 is a trailer or a semitrailer.

Further features and advantages of the invention will become apparent from the following detailed description of nonlimiting embodiments of the invention, with
10 reference to the appended figures, in which:

- figure 1 schematically shows a perspective and exploded view of a chassis having modules according to the invention;
- 15 - figure 2 schematically shows an elevation view of a first variant of fitting such modules together;
- figure 3 schematically shows an elevation view of a second variant of fitting such modules together;
- figure 4 schematically shows a partial
20 elevation view of an example of the combination of modules, in a longitudinal direction, similar to figure 1;
- figure 5 schematically shows a partial elevation view of another example of the combination of
25 modules;
- figure 6 schematically shows a partial elevation view of an example of the combination of two modules;
- figures 7 and 8 schematically show partial
30 elevation views of yet more examples of the combination of modules;
- figure 9 schematically shows a perspective view of a combination of modules in a transverse direction;
- figure 10 is an end view of the combination
35 from figure 9;
- figure 11 schematically shows a perspective bottom view of a detail of a module according to the invention;

- figure 12 schematically shows a perspective top view of another detail of a module according to the invention;

5 - figure 13 schematically shows a perspective top view of yet another detail of a module according to the invention;

10 - figures 14, 15 and 16 schematically show respectively a self-propelled vehicle, a semitrailer and a trailer for transporting containers according to the invention.

The present invention relates more particularly to the field of heavy handling, in particular port handling.

15 The invention relates to a module 10 for a modular chassis 1 of a vehicle 100 for transporting heavy loads.

20 Such a module 10 can have different forms, as shown in the rest of the description, with examples of modules 10 under the references 2, 3, 4, 200, 201, 202, 300, 400, 401.

25 According to the invention, in order to ensure at the same time the best flexural behavior of the chassis 1 of the vehicle 100 formed by such modules 10, a module 10 has at at least one of its ends a joining surface 12 which has at least one oblique support surface 13 that extends between two planar surfaces 14 and 15 that are
30 parallel to one another and inclined with respect to said oblique support surface 13.

Such a module 10 is designed to be able to engage with, as the case may be, a structure to which it is
35 attached, or else with another module 10A, said structure or said other module 10A having a complementary joining surface 12A which has at least one complementary oblique support surface 13A that

extends between two complementary planar surfaces 14A and 15A that are parallel to one another and inclined with respect to said oblique support surface 13A, as is shown in figure 2, the module 10 then forming with said structure or with said other module 10A an assembly having an oblique scarf joint, known as an unconnected skew scarf joint.

The load applied to the module 10A is absorbed by the oblique surface 13, and such an assembly, which is only used in wooden framework, and is introduced here in an innovative manner in metal structures, provides very good flexural strength. Such an assembly is designed to hold, statically, under the effect of the weight of each of its components, and of forces applied thereto parallel to the planes of their planar surfaces 14, 14A, 15 and 15A. Since the vehicles 100 are intended to travel on uneven ground, and to perform turns, it is nevertheless necessary to add mechanical fastening means, if only to ensure transverse retention. To this end, fitting elements such as bolts or the like are deployed in a direction D perpendicular to the planes of the planar surfaces 14, 14A, 15 and 15A and at the level of the latter. The assembly having a scarf joint makes it possible for these fitting elements to operate only in traction without any shear forces.

Figure 3 illustrates a fitting variant having a scarf joint having a key: the joining surface 12 then has two oblique support surfaces 131 and 132 which are parallel to one another, and the joining surface 12A also has two oblique support surfaces 131A and 132A which are parallel to one another. The length of the surface 132 is less than that of the surface 132A and the length of the surface 131A is less than that of the surface 131. Thus, in the mid part of the assembly, there is left a space which is designed to be able to hold a key 11 that secures the assembly known as an oblique scarf

joint having a key. Such a key 11 improves the behavior in traction of the connected assembly. It also makes it possible, in certain cases, to dispense with fitting screws. Such a key 11 can have parallel faces or else
5 be in the form of a wedge.

The invention also relates to a modular chassis 1 of a vehicle for transporting heavy loads having at least two such modules, each having at at least one end a
10 joining surface designed to be able to engage with a complementary joining surface on another module. In this chassis 1, according to the invention, said joining surface and said complementary joining surface form together an assembly having an oblique scarf
15 joint, having an unconnected skew scarf joint or having a key. Such a modular chassis 1 makes it possible in particular to construct vehicles 100, in particular port vehicles, for transporting ISO containers. Such a chassis 1 can of course be used for other applications,
20 on account of its highly multipurpose nature.

Figures 4 to 8 show a plurality of types of modules 10, and a plurality of conceivable combinations, depending in particular on the nature of the load to be
25 transported and on the distribution of its mass.

Figure 4 illustrates the preferred configuration, with an intermediate module 200 of a first type enclosed by end modules of a first type 300 and 400, the
30 intermediate module 200 then forming a keystone. The module 400 can in particular be identical to the module 300. Figure 7 illustrates an extended variant thereof, having extension modules 201, the oblique surfaces of which are parallel to one another.

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Figure 6 illustrates another variant, combining an end module of the first type 300 and an end module of a second type 401, the joining surface 12 of which is

complementary to that of the end module of the first type 300. Figure 5 illustrates an extended variant thereof with an extension module 201 inserted.

5 Figure 8 illustrates another variant, incorporating an intermediate module 202 of a second type, each of the joining surfaces 12 of which is complementary to that of the end module of the first type 300. This example combines an intermediate module 202 of a second type
10 which is enclosed by two intermediate modules 200 of a first type, which are themselves enclosed by end modules of a first type 300 and 400.

It is understood that numerous configurations can be
15 produced with a small number of types of modules, in this case limited to five within the scope of these examples.

A chassis 1 according to the invention has a plurality
20 of connected modules 10. It is understood that while connection in the lengthwise, or longitudinal direction, as shown in figure 1 and in figures 4 to 8, is the preferred application, the chassis 1 can also be composed of a plurality of modules connected in the
25 widthwise, or transverse direction, as shown in figure 9 and in figure 10 as seen in the frontal direction A, in order to carry very bulky loads, or quite simply to multiply the carrying capacity for containers by a whole number. A vehicle 100 can thus have a matrix-type
30 chassis 1 with elements connected both lengthwise and widthwise, like the one shown in figure 9.

The same organization of the space is also possible in
the third, height direction, which is advantageous in
35 ports or in the field of the handling of very heavy loads, in particular in order to act on the distribution of loads on the load-bearing axles or/and engines, and in particular to carry ballast located in

appropriate regions of the vehicle structure. This ballast is preferably loaded on top of a basic chassis 1 and can itself result from stacking a plurality of ballast sheets.

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Consequently, the chassis 1 according to the invention can have three-dimensional modularity.

10 Preferably, and as shown in figure 1, the module 10 has at least two side members 21 and 22, in particular having a U-shaped profile with a variable section that is optimized for mechanical strength in a longitudinal direction. The module 10 advantageously has at least one cross member submodule 24 for taking the load in a
15 transverse direction, said side members and cross member forming a flexurally and torsionally rigid box assembly.

The cross member submodule 24 is fitted on the side
20 members 21 and 22 by a mechanical connection of the half-length type. The cross member submodule 24 ensures the function of guiding and retaining the load, in particular containers, on the chassis 1 and forms a V-block for centering at the same time as means for
25 stopping at sloped wedges 50. The latter are terminated at their upper end or turned toward the load by radiused regions that are obtained by shaping sheet metal, or by connected tubes or rounds 240, so as to enable nonaggressive contact between the cross member
30 submodule 24 and the containers, as is shown in figure 12. The parts of the cross member submodule 24 that are offset with regard to the side members 21 and 22 form arms 241; the latter and the sloped wedges 50 are advantageously produced as per application FR 07 59762
35 from the same applicant.

In an innovative and advantageous manner, the most protruding regions of the chassis 1, which are

generally formed by such arms 241, extending toward the outside of the chassis, of cross member submodules 24, are protected, preferably on either side, by oblique bumpers 242. The latter, which have a rigid design in the form of a slide, are designed to be able to deflect the module 10 during a collision with an obstacle, and thus make it possible to divert the path of the vehicle 100 incorporating such a module 10 away from the obstacle. Moreover, they form stiffening means for the arms 241 in a horizontal plane. The module 10 also has cross members 25 and gussets 26 for stiffening purposes.

The module 10 preferably has inertial blocker submodules 27, each having at least one mobile stop 271 which is designed to come into abutment against a fixed stop 272, as can be seen in figure 13. Advantageously, these modules 27 are produced as per application FR 07 56916 from the same applicant.

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The chassis 1 according to the invention has at least two modules. In one particular exemplary embodiment, as shown in figure 1, the chassis 1 forms the structure of a port semitrailer 103, as shown in figure 15, which has three modules:

- a first end module 3;
- a second end module 4;
- an intermediate connecting module 2.

30 The module 2 in figure 1 has two side members 21 and 22 and two cross member submodules 24. This particular module 2, called the intermediate module, has four joining surfaces 12 at the ends 28 of the side members 21 and 22. The modules 3 and 4 are fitted to the module 2 at these ends 28 by using fitting elements 29 such as bolts or the like. The specific forms of the joining surfaces 12 and the complementary joining surfaces 12A on the opposing modules enable the precise and rigid

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interlocking of the modules 2, 3 and 4 with one another and avoid any shear stress in the fitting elements 29. The latter can, depending on the type of stressing of the chassis assembly formed by the fitting together of the modules, be mounted, as shown in the figures, parallel to the lengthwise direction of the chassis, or else in the direction perpendicular to this same direction.

10 Similarly, the end module 3 of the example in figure 1 has two side members 31 and 32 of a type similar to the side members 21 and 22, and a submodule 24. The module 3 also has cross members 25 and inertial blocker submodules 27. The module 3 in this example has a box-like structure at its end opposite the one where it is fitted to the module 2, in order to support the loads generated by a semitrailer kingpin 30, as can be seen in figure 11. This module 3 has complementary joining surfaces 12A designed to be able to engage with joining surfaces 12 of the module 2.

The end module 4 of the example in figure 1 has two side members 41 and 42 of a type similar to the side members 21 and 22 and has a box-like structure at its end opposite the one where it is fitted to the module 2, in order to support the loads generated by at least one axle 31, as can be seen in figure 15. This module 4 has complementary joining surfaces 12A designed to be able to engage with the joining surfaces 12 of the module 2.

Preferably, the chassis 1 consisting of these modules of type 10 is dimensioned to carry ISO maritime containers of 8, 10, 15, 20, 30, 40, 45, 48, 50, 53 or 60 feet. To this end, the modules of type 10 are advantageously each longitudinally dimensioned to hold a submultiple, the exact number or a multiple of the length of standard containers. Preferably, they are

each longitudinally dimensioned to hold a submultiple, the exact number or a multiple of a 20 foot ISO 668 standard container. Preferably, the modules 10 are equipped to hold length stops in order to
5 longitudinally stop containers, or incorporate such stops in their structure. Advantageously, these longitudinal stops are also formed by blocker submodules 27.

10 In an innovative and particularly advantageous manner, at least one module 10 has such sub-blocker modules 27, which are designed to be able to act in a transverse direction of the module 10, and preferably of the chassis 1, and not just in the longitudinal direction
15 corresponding to the length of the containers. Consequently, the module 10 has sub-blocker modules 27, some of which are designed to be able to act in a longitudinal direction of the module 10 and others of which are designed to be able to act in a transverse
20 direction of the module 10, these latter not being shown in the figures. This is particularly advantageous if the module 10 is designed to hold a plurality of containers side by side in the transverse direction, in particular to directly hold the load of a multi-
25 container cross-bar, or spreader.

The invention also relates to a port vehicle 100 having at least one chassis 1, or at least one such module 10. This vehicle 100 can be, as the case may be, a self-
30 propelled vehicle 101 for transporting containers, as is shown in figure 14, a port trailer 102 for transporting containers, as is shown in figure 16, or a semitrailer 103 for transporting containers, as is shown in figure 15, these examples of combinations of
35 modules being in no way limiting.

The invention also relates to a method of fitting together such modules 10 in pairs, according to which

two modules 10 are placed end to end in order to engage a joining surface 12 on one of said modules with a complementary joining surface 12A on the other module, such that said joining surface 12 and said complementary joining surface 12A form together an assembly having an oblique scarf joint, having an unconnected skew scarf joint or having a key 11, and said modules 10 are then secured with at least one key 11 or/and fitting means 29.

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The invention also relates to a mounting tool for implementing this method, having means for lifting one of the modules 10 with respect to the other in order to engage said joining surface 12 with said complementary joining surface 12A, and means for guiding, in a direction perpendicular to the planar surfaces of said joining regions, one of said modules 10 with respect to the other.

20 To this end, each module 10 advantageously has indicating or/and aligning means for making it easier to position it next to another module 10 and to fit it to the latter. In a first variant, the module 10 has at least two bores, or trunnions, near the joining surface 12 and facing toward the outside of the module, these bores or trunnions being designed to be able to engage with at least two trunnions, or two bores, on or in the mounting tool. In another variant, which can be combined with the preceding variant, the indicating or/and aligning means are formed by at least one surface designed to be able to take the load. Advantageously, this surface is complemented by a surface which is perpendicular to it and is directed toward the outside of the module and at the joining surface on the module.

35 The invention makes it possible to envision all kinds of loading, including bulk, by carrying suitable

buckets, which can also be modular, or else tanks, said accessory containers or tanks of the invention advantageously being produced with a support base having dimensions identical to those of an ISO standard container.

In this connection, dimensions in feet are usually used in the field of containers and are used in French standards such as NF ISO 668. The reader will find below the approximate metric values, to one decimal place, of the dimensions mentioned in the present application:

	8 feet:	2.4 m
	10 feet:	3.0 m
15	15 feet:	4.6 m
	20 feet:	6.1 m
	30 feet:	9.1 m
	40 feet:	12.2 m
	45 feet:	13.7 m
20	48 feet:	14.6 m
	53 feet:	16.2 m
	60 feet:	18.3 m.

CLAIMS

1. A module (10) for a modular chassis (1) of a vehicle (100) for transporting heavy loads, characterized in that it has at least one of its ends a joining surface (12) which has at least one oblique support surface (13) that extends between two planar surfaces (14, 15) that are parallel to one another and inclined with respect to said oblique support surface (13).

2. The module (10) as claimed in the preceding claim, characterized in that it has at least two side members (21, 22) having a U-shaped profile with a variable section that is optimized for mechanical strength in a longitudinal direction, and at least one cross member submodule (24) for taking the load in a transverse direction, said side members and cross member forming a flexurally and torsionally rigid box assembly.

3. The module (10) as claimed in the preceding claim, characterized in that said cross member submodule (24) forms a V-block for centering the load at the same time as means for stopping at sloped wedges (50) which are terminated at their upper end or turned toward the load by radiused regions consisting of connected tubes or rounds (240).

4. The module (10) as claimed in the preceding claim, characterized in that said cross member submodule (24) has arms (241) which protrude in an offset manner toward the outside with respect to said side members (21, 22) and which are protected on either side by oblique bumpers (242) in the form of slides designed to be able to deflect said module (10) during a collision with an obstacle.

5. The module (10) as claimed in the preceding claim, characterized in that said oblique bumpers (242) form stiffening means for said arms (241) in a horizontal plane.

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6. The module (10) as claimed in one of the preceding claims, characterized in that it has inertial blocker submodules (27), each having at least one mobile stop (271) which is designed to come into abutment against a
10 fixed stop (272).

7. The module (10) as claimed in the preceding claim, characterized in that it has such sub-blocker modules (27), some of which are designed to be able to act in a
15 longitudinal direction of said module (10) and others of which are designed to be able to act in a transverse direction of said module (10).

8. A method for fitting together modules according to
20 one of claims 1 to 7 in pairs, characterized in that two modules (10) are placed end to end in order to engage a joining surface (12) on one of said modules with a complementary joining surface (12A) on the other module, such that said joining surface (12) and said
25 complementary joining surface (12A) form together an assembly having an oblique scarf joint, having an unconnected skew scarf joint or having a key (11), and in that said modules (10) are then secured with at least one key (11) or/and fitting means (29).

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9. A mounting tool for implementing the method as claimed in claim 8, characterized in that it has means for lifting one of said modules (10) with respect to the other in order to engage said joining surface (12)
35 with said complementary joining surface (12A), and means for guiding, in a direction perpendicular to the planar surfaces of said joining regions, one of said modules (10) with respect to the other, and in that it

has at least two trunnions, or two bores, which are designed to engage with at least two bores, or trunnions, on said module (10) near said joining surface (12) and facing toward the outside of said module.

10. A modular chassis (1) of a vehicle (100) for transporting heavy loads, having at least two modules (10) according to one of claims 1 to 7, each having at least one end a joining surface (12) designed to be able to engage with a complementary joining surface (12A) on another module, characterized in that said joining surface (12) and said complementary joining surface (12A) form together an assembly having an oblique scarf joint, having an unconnected skew scarf joint or having a key (11).

11. The chassis (1) as claimed in the preceding claim, characterized in that it is dimensioned to carry ISO marine containers of 8, 10, 15, 20, 30, 40, 45, 48, 50, 53 or 60 feet.

12. The chassis (1) as claimed in claim 10 or 11, characterized in that the modules (10) which it has are each longitudinally dimensioned to hold a submultiple, the exact number or a multiple of a 20 foot ISO 668 standard container.

13. A port vehicle (100) having at least one chassis (1) according to one of claims 10 to 12, or at least one module (10) according to one of claims 1 to 7.

14. The port vehicle (100) as claimed in the preceding claim, characterized in that it constitutes a self-propelled vehicle (101) for transporting containers, or a port trailer (102) for transporting containers, or a semitrailer (103) for transporting containers.