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(54) **Forklift mast**

(57) A telescopic mast for a vehicle such as a forklift truck that includes at least an outer mast part (CM4) and an inner mast part (CM3). The outer and inner mast parts are slidable with respect to each other and the outer and inner mast parts (CM4, CM3) are each provided respectively with an outer pair (15) and an inner pair (5) of left and right profile elements (15L, 15R; 5L, 5R). The inner pair (5) of left and right profile elements (5L, 5R) of the inner mast part (CM3) are mounted in between the outer pair (15) of left and right profile elements (15L, 15R) of the outer mast part (CM4). The left and right profile elements (15L, 15R) of the outer pair (15) are shorter in length than the left and right profile elements of the inner pair (5).

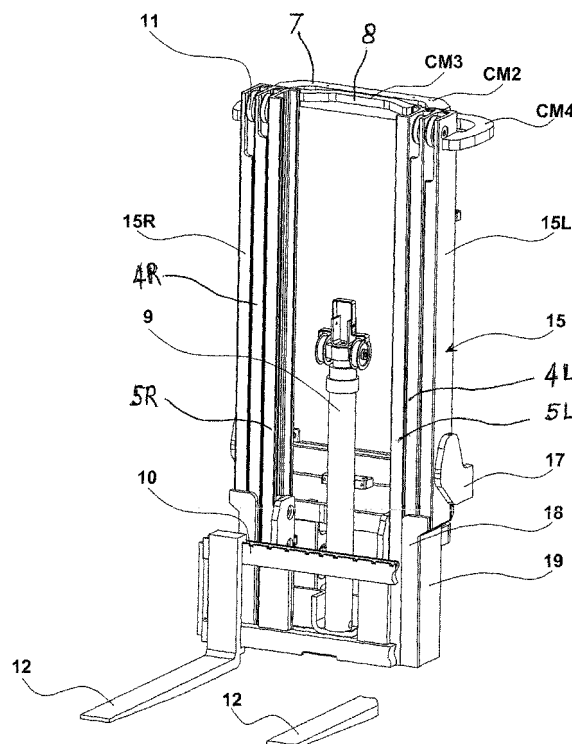


FIG. 3

Description

[0001] This invention relates to a mast for forklift trucks, and similar machines. More specifically this invention relates to a telescopic mast with an increased visibility range, through the middle of the mast.

[0002] A number of proposals to improve the forward visibility through a mast have been published in the Japanese utility models JP 59-123.096 and JP 62-132.099, as well as the United States patent documents US 7096999, US 6505710 and US 5000293. In these known constructions certain parts of the lifting mechanism have been positioned in such a way that the obstruction in the visibility range is minimised. Nevertheless, the view remains obstructed by individual parts of the telescopic mast. Conventionally masts are customarily positioned in between the wheels or other transport of the forklift truck and extend straight up from there, not considering welded on parts. In this case, the mast profiles are all more or less the same length and the positioning of the outer mast parts will determine the position of the inner mast parts.

[0003] Accordingly it is one of the present invention's objects to meet the general need of the operators of the forklift trucks to have a better view in surveying the forks of their trucks as well as the cargo which is to be lifted or transported. This view would normally be obstructed as the operators are seated behind the mast and these have to look through a free space between vertical members of the mast to see what is happening in front by the tips of the forks. More specifically it is the object to improve the operator's view in a forward direction from the driver's seat through the opening in between the vertical mast members of the cargo to be lifted and transported in such a way that the operator can operate with more confidence and greater speed yet decrease any damage to cargo and pallets. In a more general sense it is thus an object of the invention to overcome or ameliorate at least one of the disadvantages of the prior art. It is also an object of the present invention to provide alternative structures which are less cumbersome in operation and which moreover can be made relatively inexpensively. A particular object of the invention is to provide an alternative mast structure that allows the mast to be positioned partially above the wheels of a forklift truck. Alternatively it is also an object of the invention to at least provide the public with a useful choice.

[0004] To this end the invention provides a telescopic mast for a vehicle such as a forklift truck including at least an outer mast part and an inner mast part, which outer and inner mast parts are slidable with respect to each other, wherein the outer and inner mast parts are each provided respectively with an outer pair and an inner pair of left and right profile elements, wherein the inner pair of left and right profile elements of the inner mast part are mounted in between the outer pair of left and right profile elements of the outer mast part, and wherein the left and right profile elements of the outer pair are shorter in length than the left and right profile elements of the

inner pair.

[0005] The operator's visibility range is increased with the mast according to this invention, by placing the guiding profiles, also called mast profiles, more outwardly. The outer mast profile is therefore positioned above the tyres of the forklift truck. By placing this mast profile above the wheels, tyres, or any other transport means or conveying means such as caterpillar tracks, this profile will be shorter than the inner mast profile(s), so that the fork carriage will be able to be lowered right down to the ground. Thus the characteristics of this invention are that the outer mast profile(s) is situated above the tyres or wheels and the fact that there is a difference in length between the different mast profiles. When all parts have been lowered and the mast is therefore in its lowest position, all parts of the mast profiles will be lined up at the top, whereas at the base, the inner profile(s) extends between the tyres and wheels, and the outer one not. In a solution according to the invention, the outer mast profiles are partially or entirely positioned above the wheels or tyres to create a wider opening to the inner mast section. The increased mast opening offers a significantly better view of the forks compared to the conventional forklift mast with comparable clearance height. A comparable lifting height can easily be re-established by adding additional shorter mast parts outwardly of the inner mast part.

[0006] The telescopic mast according to the invention can also optionally be provided with an additional middle mast part with a middle pair of left and right profile elements, arranged to be slidable in a position with the left and right profile elements of the outer pair outwardly and with the left and right profile element of the inner pair inwardly of the left and right profile elements of the middle pair of the middle mast part. In such an arrangement it is preferred when the left and right profile elements of the middle pair are shorter than the left and right profile elements of the inner pair. By also keeping the additional middle mast part shorter, the middle mast profiles may also be positioned above the front wheels of a forklift truck.

[0007] It can also be advantageous when the telescopic mast further includes a fork carriage, adapted to carry at least one single fork, clamp, or other attachment for carrying a load. This fork carriage can be attached to the inner mast part, when the outer mast part's lower end is adapted to be attached to a vehicle, such as a forklift truck, preferably with the option of being tilted with respect thereto. Alternatively the fork carriage can also be attached to the outer mast part, when only the inner mast part and not the outer mast part's lower end is adapted to be attached to a forklift truck. A general benefit of telescopic masts for forklift trucks is that an increased lifting height does not need to result in an increased height of the forklift truck. There is some freedom in design as to whether the innermost mast part or the outermost mast part is attached to the truck. As a consequence the fork carriage will then be carried by the other of the inner and

outermost mast part.

[0008] In a further embodiment of the invention the telescopic mast preferably has the individual pairs of left and right mast profiles arranged to be unequal in length, with respect to each other, and with a front view of the assembled mast being wider at its top and narrower at its bottom and being inherently funnel shaped.

[0009] The invention thus relates to a new specific construction of the outer mast part i.e. the outer mast parts for forklift trucks, reach trucks, stackers and otherwise of machines which move pallets and/or goods in a vertical manner, with a particular purpose of creating a better view through the mast of the goods to be moved or lifted. With this new construction, according to the invention, the outer mast part i.e. the outer mast parts of a triple mast, are positioned partially or entirely above the tyres which causes the mast profiles to be a bit wider apart, thus resulting in a wider opening in the inner mast part. In comparison with the conventional constructions, the wider opening provides a significant improvement in visibility of the forks and the load to be lifted. Therefore, an important aspect of this invention is positioning the outer mast profiles entirely or partially above the tyres or the conveying means of the forklift truck.

[0010] The invention also provides a combination of a forklift truck and a telescopic mast having the technical features of the invention. For such a combination it is further advantageous when the pair of inner mast profiles is positioned in between front wheels while the outer pair of left and right mast profiles is positioned above the wheels, wherein the individual pairs of left and right mast profiles are unequal in length and wherein a frontal view of the assembled mast is inherently funnel shaped, being wider at its top and narrower at its bottom. In such a combination it is also preferred when the left and right mast profile of each outer mast part's lower end join the lower narrowest part of the funnel construction, the lower narrowest part of the outer mast profile, which has no guiding function, thereby serves to mount the mast to the forklift truck and pivotably connects to a titling point at a front axle of the forklift truck.

[0011] The combination according to the invention may also advantageously have the outer left and right mast profiles, positioned either entirely or partially above the wheels or like conveying means of the forklift truck. In such a preferred combination the lower narrow part of the outer mast part can advantageously be mounted towards the back, diagonally above the axle. In such an arrangement, or alternatively, the titling point of the mast may be positioned higher than the lower narrow part of the outer mast part.

[0012] The combination according to the invention may also preferably be equipped with a triple or multiple part mast and have the middle pair of mast profiles substantially the same length as the outer mast part, but shorter than the mast profiles of the inner mast part, so that the middle pair of mast profiles, similar to the outer pair of mast profiles, can be positioned above the wheels.

[0013] There is a lot to be gained with regard to the visibility through the masts in the triple or multiple masts by placing the middle mast profiles, just like the outer mast profiles, above the wheels or tyres and therefore not extending it towards the bottom, in between the wheels. The length of the middle mast profile(s) is thereby virtually the same as that of the mast profile of the outer mast part and thus shorter than the mast profile of the inner mast part. This particular type is not in particular described or illustrated in the accompanying drawing, but will be easily conceived by a skilled person. In this particular case an important aspect of the view of the inherent funnel shaped outer mast part remains, the funnel shape however, becomes wider at the top.

[0014] The above and further objects, features and advantages of the invention will be clarified in more detail by the below description of preferred embodiments in conjunction with the accompanying drawings, in which:

Figure 1 shows a schematic top view of a conventional forklift truck with a triple telescopic mast;

Figure 2 shows a schematic top view of a forklift truck fitted with a telescopic mast according to the invention;

Figure 3 shows a perspective view of the assembled telescopic mast according to the invention;

Figure 4 is a schematic frontal view of the telescopic mast according to the invention as fitted to a forklift truck, in which the forks and the fork carriage have been omitted for clarity; and

Figure 5 is a side view of a middle mast part.

[0015] Figure 1 is a schematic top view of a conventional triple mast, in which the limited visibility of an operator 1 has been indicated by sight lines 2. The sight lines 2 represent the visibility range of a conventional forklift mast (not considering a possible additional obstruction by presence of any lift cylinders). A forklift mast includes of several mast guiding parts, these are called mast profiles 3, 4 and 5, each being in pairs to the left and right. The respective left and right outer mast guiding profiles can also be referred to as 3L and 3R. The respective left and right middle mast guiding profiles can also be referred to as 4L and 4R. The respective left and right inner mast guiding profiles can also be referred to as 5L and 5R. The pairs of left and right mast guiding profiles are interconnected by upper connecting bridges at the top 6, 7, 8 and by further connecting bridges at the bottom (not illustrated, but generally conventional). An outer upper connecting bridge 6 connects the outer pair of mast profiles 3 of an outer mast part CM1. A middle upper connecting bridge 7 connects the middle pair of mast profiles 4 of a middle mast part CM2. An inner upper connecting bridge 8 connects the inner pair of mast profiles 5 of an inner mast part CM3. Together these form the mast parts CM1, CM2 and CM3, respectively. A complete mast always includes a minimum of two mast parts CM1 and CM2, which slide in and out of each other in

order to lift the cargo. Triple-and four part masts are available to lift to higher heights. A triple mast is the most common one and will be described as an example in relation to the accompanying drawings. The invention, however, can also be applied to any other mast type. The various mast parts CM1, CM2 and CM3 slide up and down in each other, driven by two hydraulic lift cylinders or cables (not illustrated but known to the skilled person) which have been positioned to the left and right behind the mast parts CM1, CM2 and CM3. Inside the mast part CM3 a free lift cylinder 9 may be placed for free lifting. This means that a fork carriage 10 will be lifted without the mast parts CM2 and/or CM3 sliding up. Mast rollers 11, such as wheels with steel bearings, are used to enable mast parts CM1, CM2 and CM3, which contribute to the guiding inside the u-shaped mast profile 3, 4 and 5, to slide in and out.

[0016] The outer mast part CM1 is mounted to the machine and the inner mast part CM3 carries the fork carriage 10 on which forks 12 are mounted. By a triple mast, a middle mast part CM2 can be placed in between the inner and outer mast part.

[0017] Characteristic of these conventional masts, as indicated in Figure 1, is that all mast profiles 3, 4 and 5 are situated in between the tyres of the forklift truck, that the lengths of the different mast profiles 3, 4, 5 are essentially the same and that these are straight in shape.

[0018] Figure 2 in a schematic top view shows a triple mast, according to the invention, in which the wider visibility range of the operator 1 is indicated by sight lines 14. Here it is clearly visible that a pair of outer mast profiles 15 of an outer mast part CM4, are each positioned above the wheels or tyres, such as the front wheels 16 of the forklift truck. The outer upper connecting bridge 6 interconnects the individual left and right mast guiding profiles (15L and 15R in Figure 3) of the outer mast part CM4.

[0019] Figure 3 is a perspective illustration of a complete three part telescopic mast according to the invention, in which the fork carriage and the fork is partially deleted where it meets with the outer mast part, to better show the shape of the outer mast part at its bottom. In this portion of Figure 3 it can be seen that the outer mast part CM4 has been narrowed at its bottom, a pair of mast profiles 15 of this outer mast part ends just beneath the mounting 17 for a tilt cylinder. The tilt cylinder mounting 17 is a welded on part for fixation of tilt cylinders (not shown, but conventional). Each right hand and left hand guiding profile 15R, 15L of the mast profiles pair 15 is narrowed at this point to form a kind of supporting frame, constructed from first and second plates 18 and 19, which support the mast profile 15 in such a way that the narrowed supporting frame is situated in between the wheels or tyres of the forklift truck and the mast profiles 15 being arranged on top thereof. The first and second supporting frame plates connect the pair of outer mast guiding profiles 15 to a mast tilting point, for tilting about a front axle of a forklift truck. The mast thereby takes a funnel-like

shaped as a result of being wider at its top and narrower at its bottom. The bottom mast rollers 11 have been placed on the mast part which is placed inside CM2, in such a way that these, with a descended mast, stay just above the narrow part of the outer mast CM4 thus resulting in a difference in length of the mast profile (guiding parts) of the outer mast part CM4 and the inner and outer mast parts CM2, CM3 which are situated inwardly thereof. A significant aspect of this mast according to the invention, is that the inner mast profiles 4 and/or 5 are situated in between the tyres whilst the outer mast profile 15 has been placed above the tyres, that the length of the different mast profiles 15, 4 and 5 are not equal and that a frontal view of this assembled mast has a funnel shape. The right and left guiding mast profiles 15R, 15L are considerably shorter as these only extend from above the wheels. The including lower narrow part of the outer mast part CM4 is mainly situated in between the wheels, has no guiding function and connects the outer mast profile to the tilting point for the mast at or near a front axle of a forklift truck.

[0020] Figure 4 is a frontal view of an entire mast mounted to a forklift truck, but with the forks and the fork carriage deleted for clarity. The funnel shape is clearly recognisable as well as the fact that the right hand and left hand mast profiles 15R, 15L are positioned above the wheels 16 and that the guiding mast profiles 15R, 15L does not extend from the bottom. Furthermore it can be seen that the middle mast part CM2 at its bottom extends beyond the guiding mast profiles 15R, 15L of the outer mast part CM 4 and that the guiding mast profiles 4 of this mast part CM2 is the first guiding part which is situated in between and adjacent to the wheels 16.

[0021] In the frontal view the inherent funnel shaped construction of the mast can be clearly seen in which the outer mast part is narrower at the bottom in between the tyres or wheels and wider at the top above the wheels. The mast profile of the outer mast part CM4 is situated above the funnel construction, the lower narrower part which has no guiding function, is for mounting the mast to the forklift machine at the tilting point of its the axle. This part can also be constructed differently, for example by arranging it toward the back (slanted) above the axle, or in the event that the tilting point of the mast would be higher.

[0022] Figure 5 is a side view of the second mast part CM2. The pair of mast profiles 4 of this mast part CM2 are situated nearest to the wheels (16 in Figure 4). Shown clearly in Figure 5 is that the bottom mast roller 11 has been placed at a higher level to engage with the shorter outer mast part profiles (15 in Figure 4), which is positioned higher above the wheels (16 in Figure 4). Part of this mast profile 4, which in some types could replace mast profiles 5, extends below the mast roller 11 and between the wheels 16. This is the moving part at the outer most side against the wheels 16. This bottom part of the guiding profile 4 mainly serves the purpose of an internal guiding profile for the fork carriage.

[0023] Thus the invention provides a widened forklift mast with better visibility and relates to an improved construction of the outer mast parts for forklift trucks offering an increased visibility range in or through the mast compared to the conventional constructions. The outer mast profiles are partially or entirely positioned above the wheels or tyres to create a wider opening at the inner mast section. The increased mast opening offers a significantly better view of the forks compared to the conventional forklift mast with comparable lifting and clearance height. In a frontal view the funnel shape is visible. Extra visibility can be obtained by placing the middle mast parts of a three part mast above the front wheels as well. Conventional masts, have up until now, been placed in between the front wheels and go straight up from there, not taking into account the welded on parts.

[0024] Accordingly there is disclosed in the above a telescopic mast for a vehicle such as a forklift truck that includes at least an outer mast part (CM4) and an inner mast part (CM3). The outer and inner mast parts are slidable with respect to each other and the outer and inner mast parts (CM4, CM3) are each provided respectively with an outer pair (15) and an inner pair (5) of left and right profile elements (15L, 15R; 5L, 5R). The inner pair (5) of left and right profile elements (5L, 5R) of the inner mast part (CM3) are mounted in between the outer pair (15) of left and right profile elements (15L, 15R) of the outer mast part (CM4). The left and right profile elements (15L, 15R) of the outer pair (15) are shorter in length than the left and right profile elements of the inner pair (5).

[0025] It is thus believed that the operation and construction of the present invention will be apparent from the foregoing description. The invention is not limited to any embodiment herein described and, within the purview of the skilled person; modifications are possible which should be considered within the scope of the appended claims. Equally all kinematic inversions are considered inherently disclosed and to be within the scope of the present invention. In the claims, any reference signs shall not be construed as limiting the claim. The term 'comprising' when used in this description or the appended claims should not be construed in an exclusive or exhaustive sense but rather in an inclusive sense. Thus the expression 'comprising' as used herein does not exclude the presence of other elements or steps in addition to those listed in a claim. Furthermore, the words 'a' and 'an' shall not be construed as limited to 'only one', but instead are used to mean 'at least one', and do not exclude a plurality. The mere fact that certain measures are recited in mutually different claims does not indicate that a combination of these measures cannot be used to advantage. Expressions such as: "means for ..." should be read as: "component configured for ..." or "member constructed to ..." and should be construed to include equivalents for the structures disclosed. The use of expressions like: "critical", "preferred", "especially preferred" etc. is not intended to limit the invention. Features which are not specifically or explicitly described or

claimed may be additionally included in the structure according to the present invention without deviating from its scope.

5 BRIEF DESCRIPTION OF THE NUMBERED PARTS IN THE

DRAWINGS

10 [0026]

- 1 operator;
- 2 conventional view sight lines;
- 3 pair of outer mast guiding profiles;
- 4 pair of middle mast guiding profiles (the middle left and right mast profiles are also referred to as 4L and 4R, see Figure 3);
- 5 pair of inner mast guiding profiles (the inner left and right mast profiles are also referred to as 5L and 5R, see Figure 3);
- 6 upper connecting bridge, which connects both mast profiles (3) of the outer mast part (CM1 and/or CM 4);
- 7 upper connecting bridge, which connects both mast profiles (4) of the middle mast part (CM2);
- 8 upper connecting bridge, which connects both mast profiles (5) of the inner mast part (CM3);
- 9 hydraulic free lift cylinder;
- 10 fork carriage;
- 11 mast roller;
- 12 fork;
- 14 improved view sight lines;
- 15 pair of outer mast guiding profiles of an improved forklift mast (the outer left and right mast profiles are also referred to as 15L and 15R, see Figure 3);
- 16 wheel and/or tyre;
- 17 tilt cylinder mounting;
- 18 first supporting frame plate for connecting the outer mast guiding profiles (15) to a mast tilting point for tilting about a front axle;
- 19 second supporting frame plate for connecting the outer mast guiding profiles (15) to a mast tilting point for tilting about a front axle;
- CM1 outer mast part of a conventional mast (assembled mast profiles with mast rollers and welded on parts); CM1 is an assembly including items 3L, 3R, 6, 11, 17, 18 and 19, as well as possibly additional connecting bridges which are not illustrated here;
- CM2 middle mast part (assembled mast profiles with mast rollers); CM2 is an assembly including items 4L, 4R, 7 and 11, as well as possible additional connecting bridges which are not illustrated here;
- CM3 inner mast part (assembled mast profiles with mast rollers); CM3 is an assembly including items 5L, 5R, 8 and 11, as well as possible additional connecting bridges which are not illustrated here; and
- CM4 Outer mast part of the improved mast according to the invention (assembled mast profiles with mast

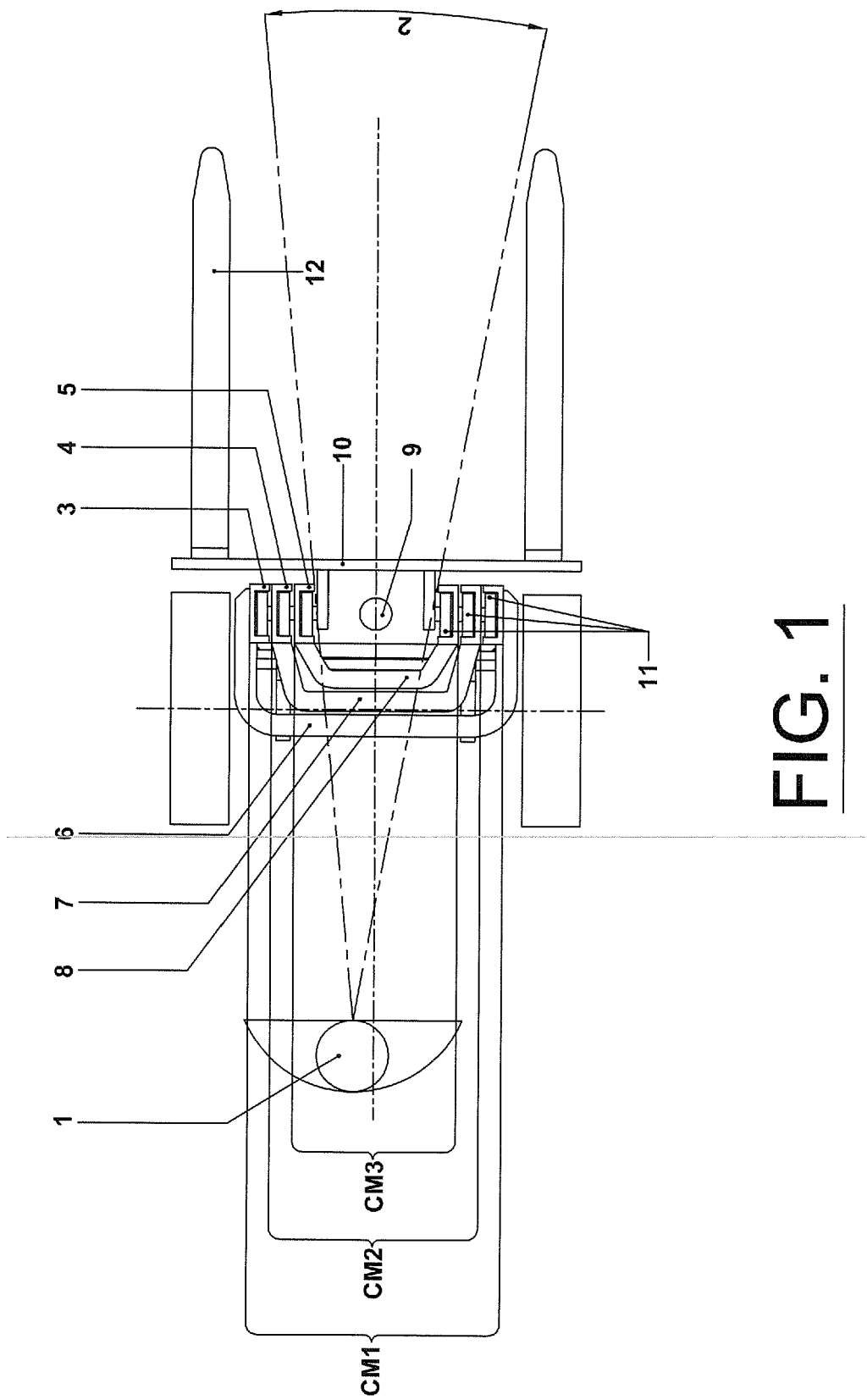
rollers and welded on parts); CM4 is an assembly including items 15L, 15R, 6, 11, 17, 18 and 19, as well as possible additional connecting bridges which are not illustrated here.

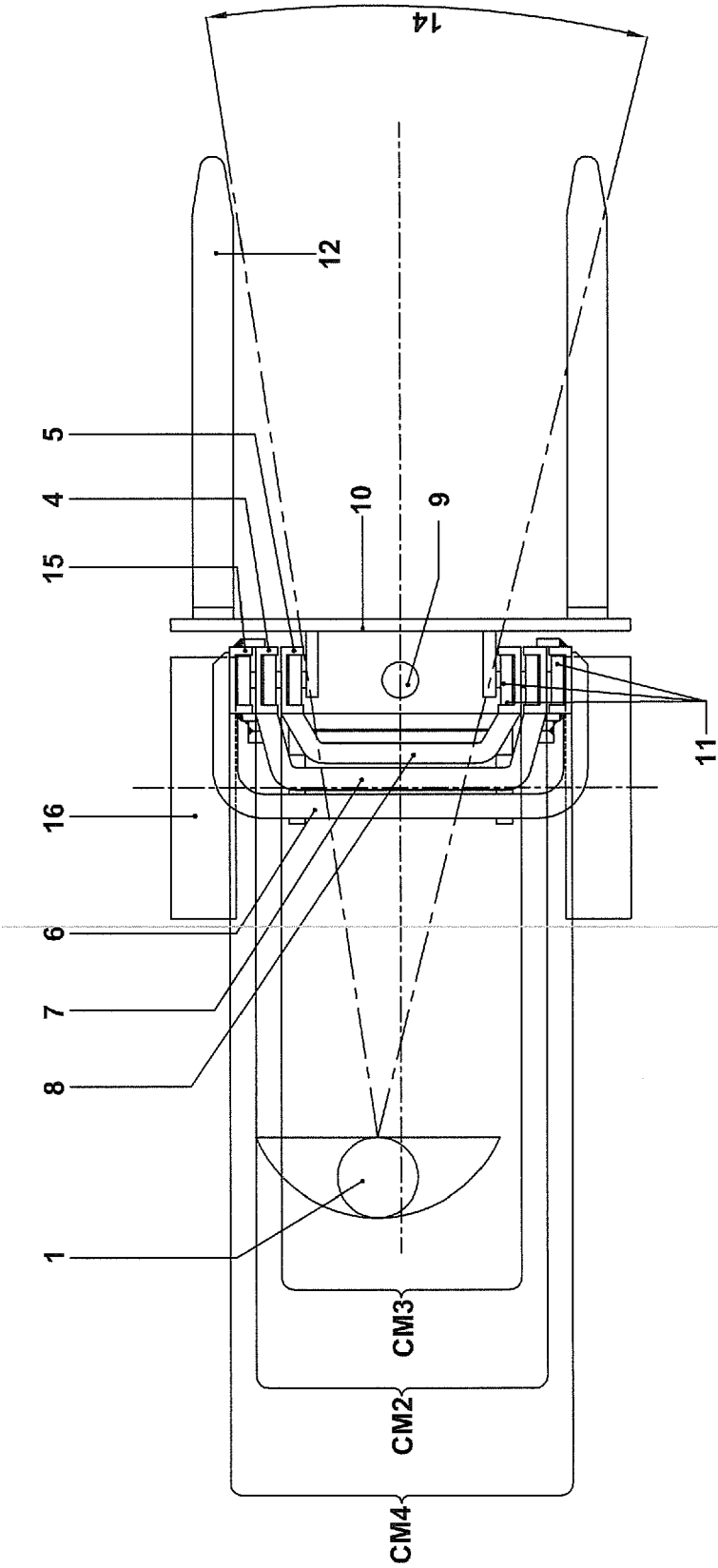
Claims

1. Telescopic mast for a vehicle such as a forklift truck including at least an outer mast part and an inner mast part, which outer and inner mast parts are slidable with respect to each other, wherein the outer and inner mast parts are each provided respectively with an outer pair and an inner pair of left and right profile elements, wherein the inner pair of left and right profile elements of the inner mast part are mounted in between the outer pair of left and right profile elements of the outer mast part, and wherein the left and right profile elements of the outer pair are shorter in length than the left and right profile elements of the inner pair.
2. Telescopic mast according to claim 1, wherein a middle mast part with a middle pair of left and right profile elements, is arranged to be slidable in a position with the left and right profile elements of the outer pair outwardly and with the left and right profile element of the inner pair inwardly of the left and right profile elements of the middle pair of the middle mast part.
3. Telescopic mast according to claim 2, wherein the left and right profile elements of the middle pair are shorter than the left and right profile elements of the inner pair.
4. Telescopic mast according to claim 1, 2, or 3, further including a fork carriage, adapted to carry at least one single fork or attachment for carrying a load.
5. Telescopic mast according to one of claims 1-4, wherein the outer mast part's lower end is adapted to be attached to a vehicle, such as a forklift truck, preferably with the option of being tilted with respect thereto.
6. Telescopic mast according to one of claims 1-4, wherein only the inner mast part and not the outer mast part's lower end is adapted to be attached to a vehicle, such as a forklift truck.
7. Telescopic mast according to one of claims 1-6, wherein the individual pairs of left and right mast profiles are unequal in length, with respect to each other, and wherein a front view of the assembled mast is wider at its top and narrower at its bottom and inherently funnel shaped.
8. The combination of a forklift truck and a telescopic

mast according to one of the claims 1-7.

9. The combination according to claim 8, wherein the pair of inner mast profiles is positioned in between front wheels while the outer pair of left and right mast profiles is positioned above the wheels, wherein the individual pairs of left and right mast profiles are unequal in length and wherein a frontal view of the assembled mast is inherently funnel shaped, being wider at its top and narrower at its bottom.
10. The combination according to claim 9, wherein the left and right mast profile of each outer mast part's lower end join the lower narrowest part of the funnel construction, the lower narrowest part of the outer mast profile, which has no guiding function, thereby serves to mount the mast to the forklift truck and pivotably connects to a titling point at a front axle of the forklift truck.
11. The combination according to claim 8, 9 or 10, wherein the outer left and right mast profiles, are positioned either entirely or partially above the wheels or like conveying means of the forklift truck.
12. The combination according to claim 11, wherein the lower narrow part of the outer mast part is mounted towards the back, diagonally above the axle.
13. The combination according to claim 11 or 12, wherein the titling point of the mast is higher than the lower narrow part of the outer mast part.
14. The combination according to one of claims 8-13, equipped with a triple or multiple part mast and wherein the middle pair of mast profiles is substantially the same length as the outer mast part, but shorter than the mast profiles of the inner mast part, so that the middle pair of mast profiles, similar to the outer pair of mast profiles, is positioned above the wheels.





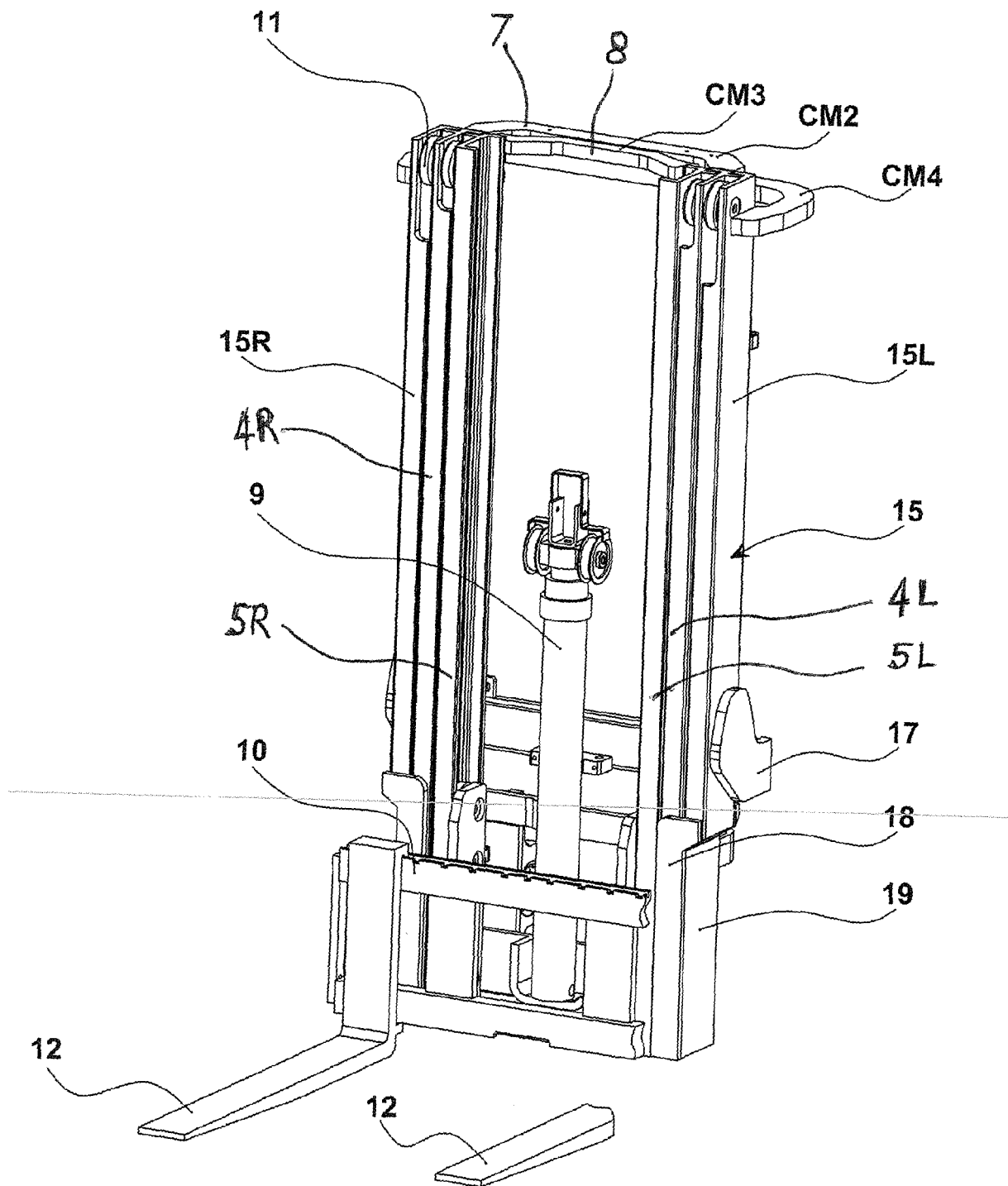


FIG. 3

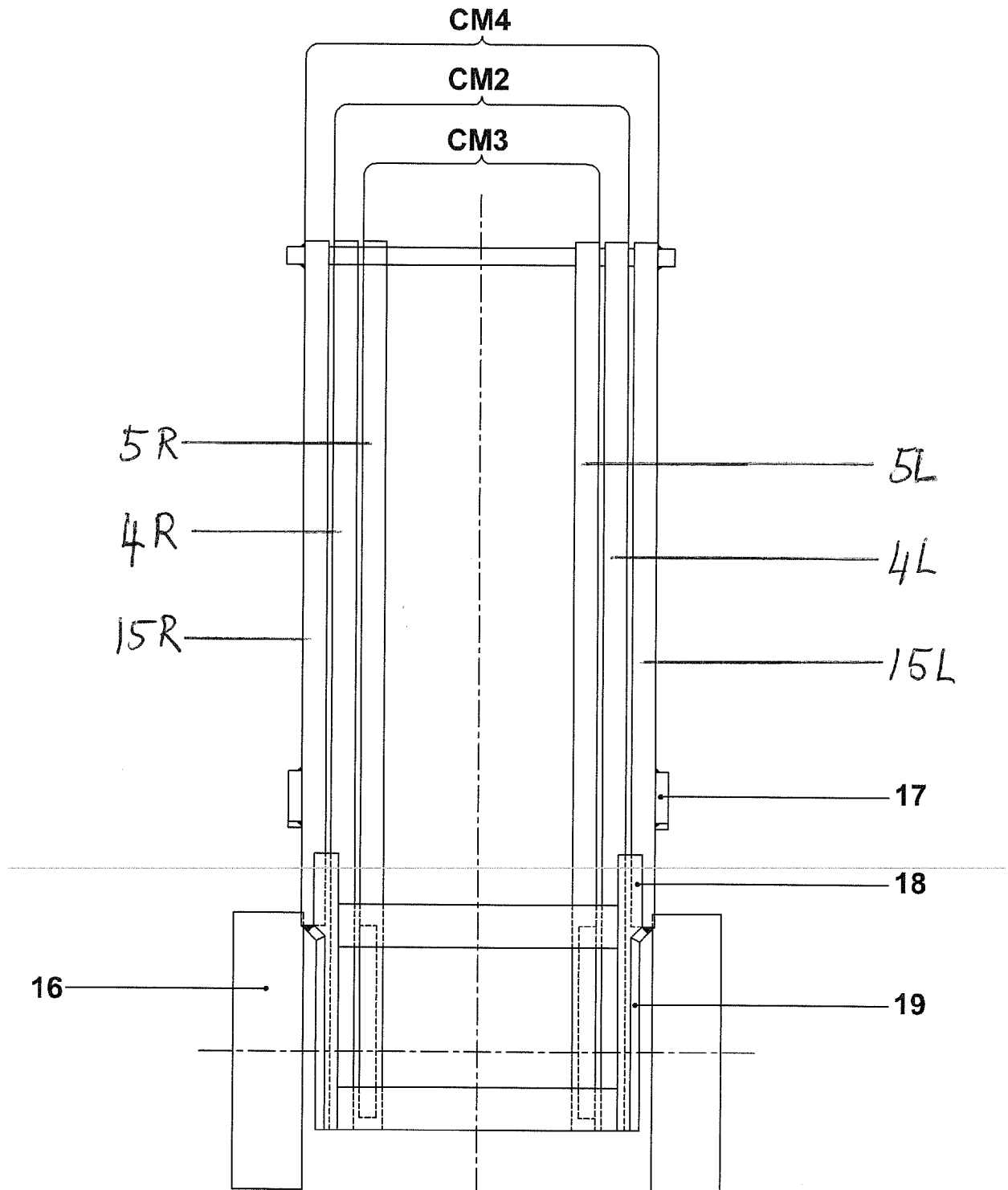


FIG. 4

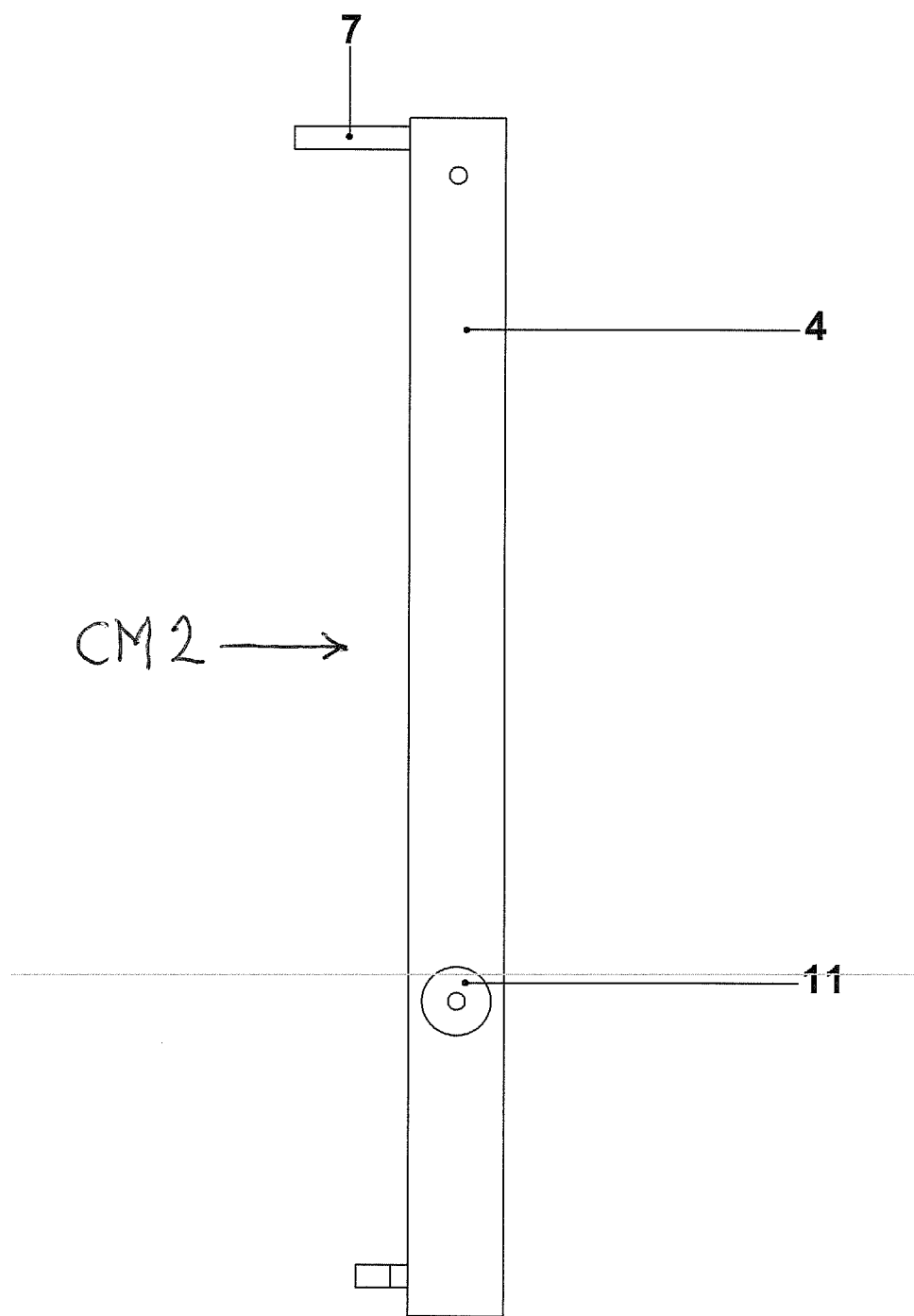


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 10 17 6891

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		7 December 2010	Guthmuller, Jacques
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 17 6891

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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07-12-2010

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