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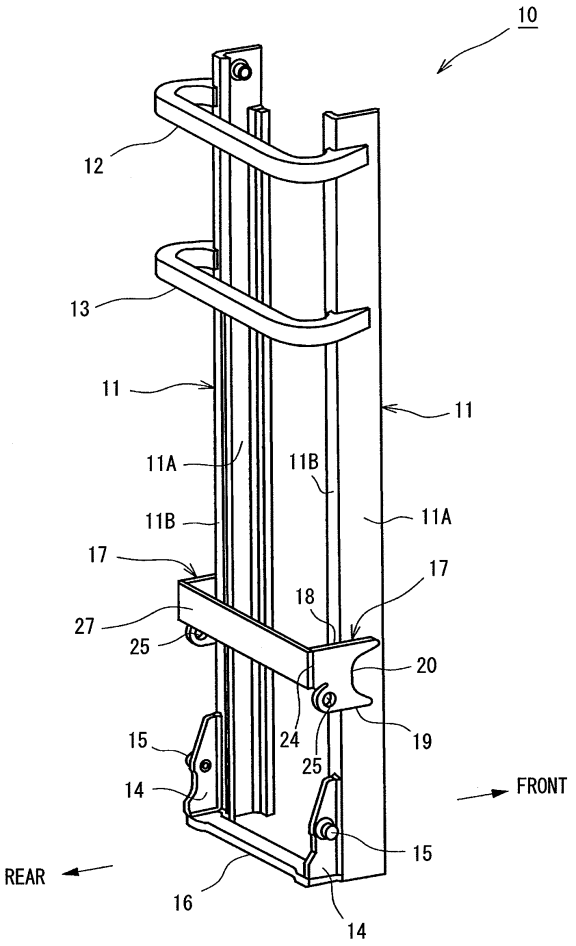
(54) Mast assembly for a forklift truck

(57) A mast assembly (10) for a forklift truck includes paired outer masts, a tilt cylinder (28) having a rod (28A), and a tilt bracket (17,37). The tilt bracket (17,37) is fixed to the outer surface of each outer mast (11) by welding for supporting an end of the rod (28A) of the tilt cylinder (28). The tilt bracket (17,37) has top (18,38) and bottom (19,39) surfaces parallel to each other, a front surface (20,40) having a welded portion (29,49) for fixing the tilt bracket (17,37) to the outer mast (11), the rear surface (24,44) facing the tilt cylinder (28), and a shaft support (25) for supporting the end of the rod (28A). The front surface (20,40) of the tilt bracket (17,37) has a continuous curved surface (21,41) which is formed a recess (H) extending toward the rear surface (24,44) of the tilt bracket (17,37). The welded portion (29,49) is formed continuously along the continuous curved surface (21,41). The welded portion has the weld end (29A,49A) located adjacent to the end of the continuous curved surface (21,41).

FIG. 1



EP 2 039 647 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to a mast assembly for a forklift truck, and more particularly to a mast assembly for a forklift truck having a tilt bracket fixed by welding to an outer mast of the mast assembly.

[0002] A tilt cylinder mounting structure for a forklift truck is disclosed in Japanese Patent Application Publication No. 4-148799, and known as a background art of a mast assembly for the forklift truck. The tilt cylinder mounting structure has a support plate fixed by welding to the outer surface of the outer mast of the forklift truck. The support plate is used for rotatably mounting a piston rod, or the front portion of the tilt cylinder, to the middle portion of the paired outer masts which are pivotable back and forth. The support plate is formed in a substantially rectangular shape, including a stepped portion having a horizontal planar surface and an inclined planar surface on the upper end of the support plate. The support plate has a welded portion formed at least on the entire front end surface and a part of the upper end surface. The end of the welded portion is located on the inclined planar surface on the upper end surface of the support plate.

[0003] According to the background art, stress concentration occurs at the welded end, and also at a point of intersection between the inclined planar surface and the horizontal planar surface of the support plate. According to the background art, stress concentration occurring at two different points helps to distribute and spread the stress concentration to such two points. Therefore, the stress concentration occurring in the welded portion may be reduced to about a half in comparison with the background art.

[0004] However, according to the background art disclosed in Japanese Patent Application Publication No. 4-148799, the length of the welded portion for fixing the support plate, which corresponds to the tilt bracket of the present invention, to the outer mast tends to be longer. The length of the welded portion should be shortened as much as possible, while considering the required welding strength. According to the background art, supposedly the support plate is made of a plate having flat surfaces. Since the support plate has a stepped portion on the upper end surface, the extraction rate of the support plate by cutting out from a raw plate material is lower in comparison with a case of making a support plate of a simple rectangular shape. Such a complicate shape of the support plate causes disadvantage in that the extraction rate is to be low, and it wastes raw plate material.

[0005] The present invention is directed to provide a mast assembly for a forklift truck which realizes improved welding strength and, simultaneously, shortened welding length of the tilt bracket and also improves the extraction rate in cutting out a tilt bracket from a raw plate material.

SUMMARY OF THE INVENTION

[0006] In accordance with an aspect of the present invention, a mast assembly for a forklift truck having a truck body includes a tilt cylinder, paired outer masts, a tilt bracket. The tilt cylinder has a rod. The paired outer masts are disposed at the front part of the truck body and pivotably move back and forth by operating the tilt cylinder. The tilt bracket is fixed to the outer surface of each outer mast by welding, and used for supporting an end of the rod. The tilt bracket is formed of a flat plate having flat surfaces. The tilt bracket has a top surface and a bottom surface parallel to each other, a front surface having a welded portion for fixing the tilt bracket to the outer mast, a rear surface facing the tilt cylinder, and a shaft support for supporting the end of the rod. The front surface of the tilt bracket has a continuous curved surface which is formed a recess extending toward the rear surface of the tilt bracket. The welded portion is formed continuously along the continues curved surface. A weld end of the welded portion is located adjacent to the end of the continuous curved surface.

[0007] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a perspective view showing a mast assembly for a forklift truck according to a preferred embodiment of the present invention;

Fig. 2 is a fragmentary side view showing the mast assembly for the forklift truck according to the preferred embodiment;

Fig. 3 is an enlarged side view showing a tilt bracket of the mast assembly according to the preferred embodiment;

Fig. 4 is an illustrative view showing a metal plate out of which the tilt bracket according to the preferred embodiment is cut; and

Fig. 5 is a side view showing a mast assembly using a tilt bracket according to an alternative embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] The following will describe the mast assembly for the forklift truck of the preferred embodiment (hereinafter referred to merely as "mast assembly") according to the present invention with reference to Fig.1 through Fig. 4. The forklift truck has a mast assembly 10 disposed at the front part of the forklift truck, which is not shown.

[0010] As shown in Fig. 1, the mast assembly 10 has a pair of left and right outer masts 11. The outer masts 11 form a part of the mast assembly 10 with inner masts (not shown) which are movable up and down on the inner side of the outer masts 11. The front and rear sides of the mast assembly 10 are indicated by opposite direction arrows in Fig. 1. The inner mast has a lift bracket (not shown) at the front of the mast assembly 10, on the rear side of which a truck body (not shown) is located.

[0011] The outer mast 11 is substantially L-shaped in transverse cross section, having a main surface portion 11A and a rear surface portion 11 B. The main surface portion 11A has outer and inner surfaces extending substantially in parallel relation to the longitudinal direction of the forklift truck. The rear surface portion 11B is provided at the rear end of the main surface portion 11A, extending in perpendicular relation to the main surface portion 11A. The rear surface portion 11B has a front surface facing frontward and a rear surface facing rearward.

[0012] The mast assembly 10 has an upper stay 12, a middle stay 13 and a lower beam 16 through which the outer masts 11 are connected to each other. The upper stay 12 is located substantially horizontally adjacent to the top ends of the outer masts 11. The upper stay 12 is welded at the opposite ends thereof to the outer surfaces of the main surface portions 11A and also to the rear surfaces of the rear surface portions 11 B of the outer masts 11. The upper stay 12 is substantially U-shaped as viewed from the top of the mast assembly 10 so as to protrude rearwardly of the outer masts 11.

[0013] The middle stay 13 is provided at a vertically spaced distance from the upper stay 12. The middle stay 13 has substantially the same structure as the upper stay 12. The upper stay 12 and the middle stay 13 are provided to improve the rigidity of the mast assembly 10. The mast bracket 14 having shanks 15 is welded to the rear surface portions 11 B at the bottom of the outer masts 11. The lower beam 16 is welded to the mast bracket 14 at the bottom thereof for improving the rigidity of the mast assembly 10 in the same manner as the upper stay 12 and the middle stay 13. The shank 15 of the mast bracket 14 is rotatably supported on the front part of the truck body, so that the mast assembly 10 is pivotable on the shank 15 in the longitudinal direction of the forklift truck.

[0014] A tilt bracket 17 is fixed by welding to each outer surface of the main surface portion 11A of the outer mast 11 at a position between the middle stay 13 and the mast bracket 14. The tilt bracket 17 is made of a metal plate having uniformly flat surfaces on the both sides, and a thickness that is enough to ensure the required welding strength of the tilt bracket 17. The tilt bracket 17 is fixed to the outer masts 11 such that a part of the tilt bracket 17 projects rearward from the outer masts 11, as clearly shown in Fig. 1. The tilt bracket 17 has a shaft hole 25 serving as a shaft support adjacent to the lower rear end of the tilt bracket 17. The mast assembly 10 has a tilt cylinder 28 (Fig. 2) having a piston rod 28A movable in and out of the tilt cylinder 28 and having at the end thereof a shank supported at the shaft hole 25 of the tilt bracket 17.

[0015] The tilt bracket 17 has a top surface 18 and a bottom surface 19 having flat surfaces, respectively, and extending parallel to each other. The tilt bracket 17 has a front surface 20 formed between the front ends of the top surface 18 and the bottom surface 19. The tilt bracket 17 also has a rear surface 24 facing the tilt cylinder 28 and formed between the rear ends of the top surface 18 and the bottom surface 19. For the sake of convenience of explanation, the outer periphery of the tilt bracket 17 shown in Fig. 3 is provided with points A though G for defining various ranges on the outer periphery. The points A through G show ranges of the top surface 18 (between points A and B), the bottom surface 19 (between points C and D), the front surface 20 (between points A and C) and the rear surface 24 (between points B and D).

[0016] The rear surface 24 has a tilt beam fixing surface 24A (between points B and G in Fig. 3) extending perpendicularly to the top surface 18. The tilt beam 27 is fixed at each end thereof by welding to the tilt beam fixing surface 24A. The tilt beam 27 is made of an elongated flat plate, and connects the paired tilt brackets 17 for improving the rigidity of the mast assembly 10. The rear surface 24 includes a connecting surface 24B (between points D and G in Fig. 3) formed between the lower end of the tilt beam fixing surface 24A of the rear surface 24 and the rear end of the bottom surface 19 by an arcuate surface extending along the shaft hole 25.

[0017] As shown in Figs. 2 and 3, the front surface 20 has a continuous curved surface 21, an upper arcuate surface 22 and a lower arcuate surface 23. The continuous curved surface 21 constitutes a substantial part of the front surface 20, and forms a recess H extending toward the rear surface 24. The upper arcuate surface 22 connects the continuous curved surface 21 to the top surface 18, and the lower arcuate surface 23 connects the continuous curved surface 21 to the bottom surface 19, respectively. The tilt bracket 17 is fixed to the outer mast 11 such that the continuous curved surface 21 presents a substantial C-shape as viewed from the side thereof. A welded portion 29 for fixing the tilt bracket 17 to the outer mast 11 is formed continuously along the curved surface 21.

[0018] The welded portion 29 has a predetermined width and the longitudinal opposite weld ends 29A and 29B thereof are located adjacent to the ends of the con-

tinuous curved surface 21, respectively. The upper weld end 29A of the welded portion 29 along the continuous curved surface 21 is positioned as far forward as possible, thereby to reduce concentration of a high stress at the weld end 29A. The tilt bracket 17 is fixed to the outer masts 11 only through the welded portion 29 formed along the continuous curved surface 21. Therefore, no other welded portions are formed on the tilt bracket 17.

[0019] The following will describe the continuous curved surface 21 more in detail with reference to Fig. 3. The continuous curved surface 21 is formed by an upper inclined planar surface 21A, a lower inclined planar surface 21 B, a middle perpendicular surface 21C, an upper curved surface 21D and a lower curved surface 21 E. The upper inclined planar surface 21A is a surface inclined and extending from the upper end (point E) toward the vertical center of the rear surface 24. The lower inclined planar surface 21 B is a surface inclined and extending from the lower end (point F) toward the vertical center of the rear surface 24 of the tilt bracket 17. The middle perpendicular surface 21C extends in perpendicular direction to the top surface 18 between the upper inclined planar surface 21A and the lower inclined planar surface 21 B. The upper curved surface 21D connects the middle perpendicular surface 21C and the upper inclined planar surface 21A. The lower curved surface 21 E connects the middle perpendicular surface 21C and the lower inclined planar surface 21 B.

[0020] With the outer masts 11 kept upright by the tilt cylinder 28, the inclined direction of the upper inclined planar surface 21A of the continuous curved surface 21 shown by the dashed line Q substantially coincides with the axial direction of the rod 28A of the tilt cylinder 28 shown by the dashed line P, as shown in Fig. 3. The axial direction of the rod 28A is substantially the same as the direction in which the rod 28A moves in and out of the tilt cylinder 28. By so arranging the tilt bracket 17, stress in the welded portion 29 can be reduced. As a result, the length of the welded portion 29 can be shortened. It is preferable that the radius of curvatures of the upper curved surface 21 D and the lower curved surface 21 E of the continuous curved surface 21 should be set as large as possible for distributing the stress in the welded portion 29.

[0021] The following will describe the operation of the mast assembly 10 according to the preferred embodiment. The mast assembly 10 is pivotable in the longitudinal direction of the forklift truck by the operation of the tilt cylinder 28. When the mast assembly 10 is thus pivoted, a load is produced in the tilt bracket 17 of the mast assembly 10 through the end of the rod 28A of the tilt cylinder 28 in the axial direction of the rod 28A.

[0022] When the load is thus generated in the tilt bracket 17, a stress whose magnitude corresponds to that of the load is produced in the welded portion 29 and distributed and spread along the welded portion 29. The welded portion 29 is formed continuously along the continuous curved surface 21 including the upper curved surface 21 D and the lower curved surface 21 E. Thus, a part of the stress applied to the welded portion 29 is distributed and spread to the upper curved surface 21 D and the lower curved surface 21 E. Therefore, excessive stress concentrations at the both curved surface 21 D, 21 E are relieved. The extending direction of the upper inclined planar surface 21A is substantially the same as the direction in which a stress acts on to the welded portion 29. Thus, the part of the welded portion 29 extending along the upper inclined planar surface 21A can resist the stress even if the stress is increased. Therefore, excessive stress concentration at the weld end 29A is avoided.

[0023] As the position of the weld end 29A is displaced forward away from the shaft hole 25 from which the load is transmitted, the stress applied to the weld end 29A is decreased. The welded portion 29, which is formed continuously along the continuous curved surface 21, can resist the stress that is due to the load acting not only in the axial direction of the rod 28A but also in the vertical and longitudinal directions of the tilt bracket 17. Therefore, the welded portion 29 keeps the tilt bracket 17 rigidly fixed to the outer mast 11.

[0024] The following will describe a cutting layout in making the tilt bracket 17 according to the preferred embodiment. As shown in Fig. 4, the tilt bracket 17 may be made by blanking or cutting a rectangular metal plate M into the desired shape. If the metal plate M is provided with a side length that is substantially the same as the distance between the top surface 18 and the bottom surface 19 of the tilt bracket 17, surplus pieces M1, M2, M3, as indicated by hatching in Fig. 4, are produced during the blanking or cutting operation.

[0025] The surplus piece M1 is produced by forming the continuous curved surface 21, the upper arcuate surface 22 and the lower arcuate surface 23 which all form the front surface 20 of the tilt bracket 17. The surplus piece M2 is produced by forming the connecting surface 24B on the rear surface 24 of the tilt bracket 17. The surplus piece M3 is produced by forming the shaft hole 25. The top surface 18 and the bottom surface 19 are parallel to each other in the preferred embodiment. Thus, the ratio of the total area of the surplus pieces M1 through M3 to the area of original metal plate M may be reduced in comparison with the conventional method of making a tilt bracket. Therefore, the waste of material is reduced.

[0026] The following advantageous effects are obtained according to the preferred embodiment.

(1) Since the welded portion 29 is formed continuously along the continuous curved surface 21 of the tilt bracket 17, the stress in the welded portion 29 may be distributed and spread along the continuous curved surface 21. The weld end 29A of the welded portion 29 is positioned adjacent to the front end of the continuous curved surface 21, and the inclined direction of the upper inclined planar surface 21A is substantially the same as the direction in which the

stress is applied to the welded portion 29. Thus, a stress concentration is hardly occurs in the weld end 29A and excessive stress concentration in the welded portion 29 is avoided.

(2) Improved welding strength and shortened welding length of the tilt bracket 17 can be achieved simultaneously by merely providing the welded portion 29 along the continuous curved surface 21 of the front surface 20.

(3) Since the welded portion 29 is provided only in the front surface 20, the top surface 18 and the bottom surface 19 of the tilt bracket 17 may be left uncut and be parallel to each other. Therefore, the tilt bracket 17 may have an advantageous shape suitable for improvement of extraction rate in making a tilt bracket 17 by cutting a raw plate material.

(4) Providing the shaft hole 25 below the tilt beam 27, the tilt bracket 17 is subjected to a relatively large force in comparison with providing a shaft hole above the tilt beam 27. Since the welded portion 29 is formed along the continuous curved surface 21, however, the welding strength in the tilt bracket 17 is highly improved in comparison with the conventional, and the tilt bracket 17 can resist the stress due to the load. Therefore, the shaft hole 25 may be disposed above or below the tilt beam 27 depending on the condition of the mast assembly 10, thereby offering a higher degree of freedom in designing the mast assembly 10.

(5) According to the mast assembly 10 of the preferred embodiment, wherein the welded portion 29 is formed along the continuous curved surface 21, the welding strength of the tilt bracket 17 is improved. Thus, no welded portion is necessary other than the welded portion at the front surface 20 of the tilt bracket 17, and, therefore, the time for welding process may be reduced.

(6) The welded portion 29 is formed along the continuous curved surface 21 of the tilt bracket 17, so that the length of the welded portion 29 may be shortened in comparison with the conventional. Thus, the operation and time for welding may be reduced. Since the continuous curved surface 21 includes an arcuate surface having a large radius of curvature, the welding may be performed by an automatic welder such as a welding robot and the like.

(7) The tilt bracket 17 of the preferred embodiment may be formed by blanking or cutting a metal plate M having flat surfaces on the opposite sides thereof without bending the material and using any other parts. Therefore, the tilt bracket 17 can be made easier in comparison with the conventional.

[0027] The following will describe an alternative embodiment of the tilt bracket 37 according to the present invention. The reference numerals used in describing the above preferred embodiment will be used to denote similar elements or parts of the alternative embodiment and the description thereof will be omitted. As shown in Fig. 5, the tilt bracket 37 is fixed to the outer surface of the main surface portion 11A of the outer mast 11.

[0028] The tilt bracket 37 has a top surface 38 and a bottom surface 39 which are parallel to each other. The tilt bracket 37 also has a front surface 40 and a rear surface 44. The front surface 40 includes a continuous curved surface 41, an upper arcuate surface 42 and a lower arcuate surface 43. The rear surface 44 facing the tilt cylinder 28 has a tilt beam fixing surface 44A and a connecting surface 44B. The alternative embodiment differs from the above preferred embodiment in that the continuous curved surface 41 forming a part of the front surface 40 is substantially vertically symmetrical with respect to dashed line R extending centrally between the top surface 38 and the bottom surface 39 of the tilt bracket 37, as shown in Fig. 5.

[0029] Thus, the tilt bracket 37 may be used for a different type of outer mast in which the tilt cylinder 28 is disposed above the tilt beam 27. With the tilt bracket 37 fixed in vertically reversed disposition to that different type of the outer mast, the lower inclined planar surface 41 B, the middle surface 41C, the lower curved surface 41 E and the lower arcuate surface 43 are provided on the upper side of the front surface 40. The positions of the lower arcuate surface 43, lower inclined planar surface 41 B, and the lower curved surface 41 E correspond to the positions of the upper arcuate surface 42, an upper inclined planar surface 41A and an upper curved surface 41 D when the tilt bracket 37 is not vertically reversed. If the tilt bracket 37 is vertically reversed and fixed to the different type of the outer mast, the lower inclined planar surface 41 B is positioned on the upper side of the front surface 40 and the direction of the lower inclined planar surface 41 B substantially corresponds to the axial direction of the rod 28A. In this alternative embodiment, the welded portion 49 is formed along the continuous curved surface 41. The welded portion 49 has a weld end 49A positioned near the upper arcuate surface 42, and a weld end 49B positioned near the lower arcuate surface 43.

[0030] According to the alternative embodiment, the continuous curved surface 41 of the tilt bracket 37 has a vertically symmetrical shape. Therefore, fixing the tilt bracket 37 in vertically reversed disposition to the outer mast, the connecting surface 44B of the tilt bracket 37 may be positioned above the tilt beam fixing surface 44A. Thus, the tilt bracket 37 is applicable to a different type of outer mast in which the tilt cylinder is fixed to the outer mast at a position above the tilt beam 27. Thus, the tilt bracket 37 may be used in vertically reversed disposition depending on types of the mast assembly 10.

[0031] The present invention is not limited to the above-described embodiments, but it may be modified

into various further alternative embodiments as exemplified below. According to the above preferred embodiment, the continuous curved surface includes the upper and lower curved surfaces and the upper and lower inclined surfaces. Alternatively, the continuous curved surface may be formed by a single arcuate surface, or by a combination of a plurality of arcuate surfaces having different radii of curvature. In such cases, it is preferable that the length of welded portion formed along the continuous curved surface should be shortened as much as possible. According to the above preferred embodiments, the tilt bracket has the shaft hole serving as a shaft support, and the rod end of the tilt cylinder has the shaft portion for insertion in the shaft hole. Alternatively, the tilt bracket may have a shaft portion, and the rod end has a shaft hole in which the shaft portion of the tilt bracket is inserted.

[0032] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein but may be modified within the scope of the appended claims.

A mast assembly for a forklift truck includes paired outer masts, a tilt cylinder having a rod, and a tilt bracket. The tilt bracket is fixed to the outer surface of each outer mast by welding for supporting an end of the rod of the tilt cylinder. The tilt bracket has top and bottom surfaces parallel to each other, a front surface having a welded portion for fixing the tilt bracket to the outer mast, the rear surface facing the tilt cylinder, and a shaft support for supporting the end of the rod. The front surface of the tilt bracket has a continuous curved surface which is formed a recess extending toward the rear surface of the tilt bracket. The welded portion is formed continuously along the continuous curved surface. The welded portion has the weld end located adjacent to the end of the continuous curved surface.

Claims

1. A mast assembly (10) for a forklift truck having a truck body comprising:

   a tilt cylinder (28) having a rod (28A);
   paired outer masts (11) disposed at the front part of the truck body and pivotably move back and forth by operating the tilt cylinder (28); and
   a tilt bracket (17, 37) fixed to the outer surface of each outer mast (11) by welding and used for supporting an end of the rod (28A),

   characterized in that the tilt bracket (17, 37) is formed of a flat plate having flat surfaces, and has a top surface (18, 38) and a bottom surface (19, 39) parallel to each other, a front surface (20, 40) having a welded portion (29, 49) for fixing the tilt bracket (17, 37) to the outer mast (11), a rear surface (24, 44) facing the tilt cylinder (28), and a shaft support (25) for supporting the end of the rod (28A),
   in that the front surface (20, 40) of the tilt bracket (17, 37) has a continuous curved surface (21, 41) which is formed a recess (H) extending toward the rear surface (24, 44) of the tilt bracket (17, 37), and **in that** the welded portion (29, 49) is formed continuously along the continues curved surface (21, 41), and a weld end (29A, 49A) of the welded portion (29, 49) is located adjacent to the ends of the continuous curved surface (21, 41).

2. The mast assembly (10) for the forklift truck according to the claim 1, **characterized in that** the continuous curved surface (21, 41) has an upper inclined planar surface (21A, 41A) whose inclined direction substantially coincides with the axial direction of the rod (28A).

3. The mast assembly (10) for the forklift truck according to the claim 1 or 2, **characterized in that** the continuous curved surface (21, 41) is substantially vertically symmetrical between the top surface (18, 38) and the bottom surface (19, 39) of the tilt bracket (17, 37).

4. The mast assembly (10) for the forklift truck according to any one of the claims 1 through 3, **characterized in that** a tilt beam (27) whose each end is fixed to the rear surface (44) of the tilt bracket (37), and the shaft support (25) of the tilt bracket (37) is disposed below the tilt beam (27).

5. The mast assembly (10) for the forklift truck according to any one of the claims 1 through 3, **characterized in that** a tilt beam (27) whose each end is fixed to the rear surface (44) of the tilt bracket (37), and the shaft support (25) of the tilt bracket (37) is disposed above the tilt beam (27).

FIG. 1

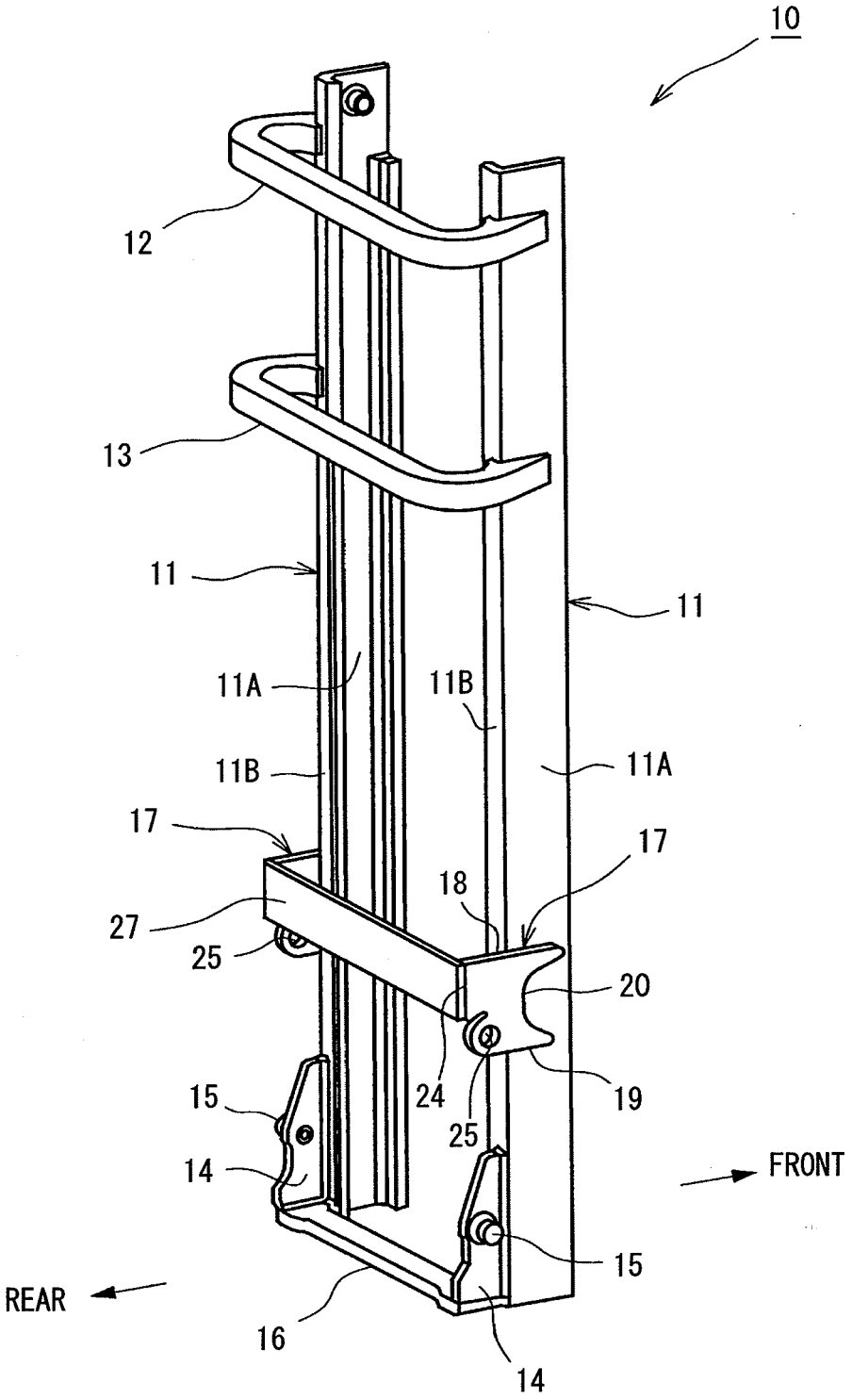

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FIG. 2

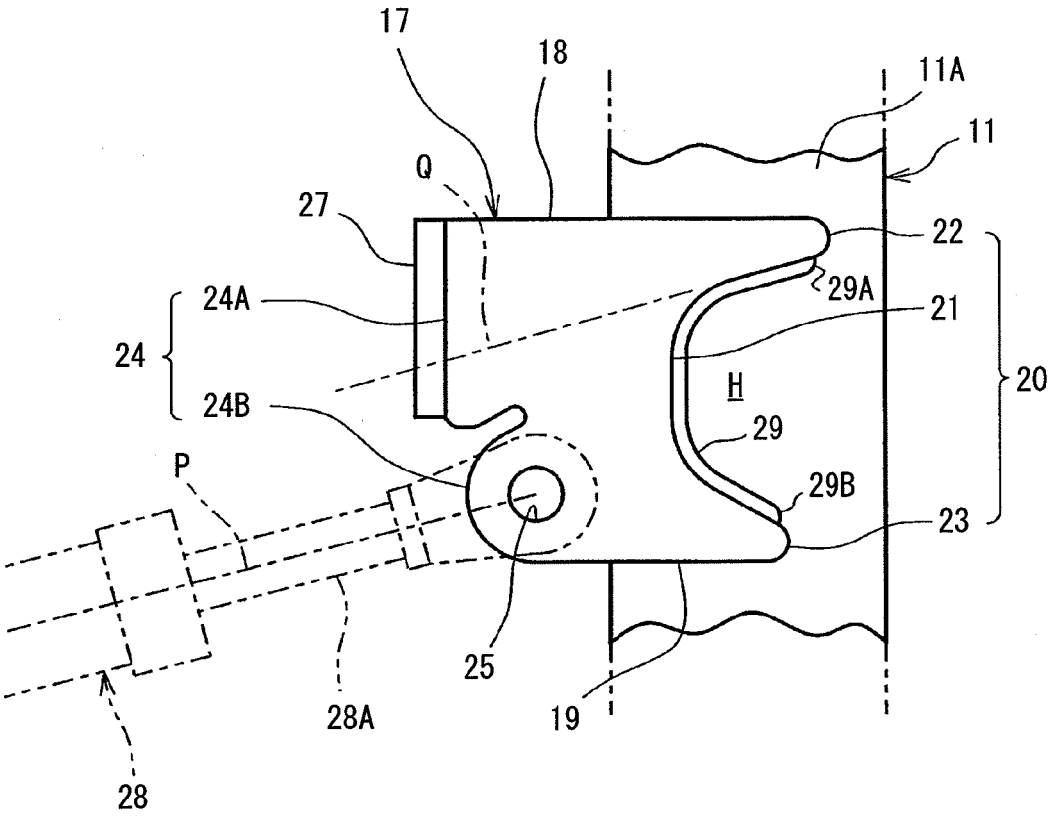

FIG. 3

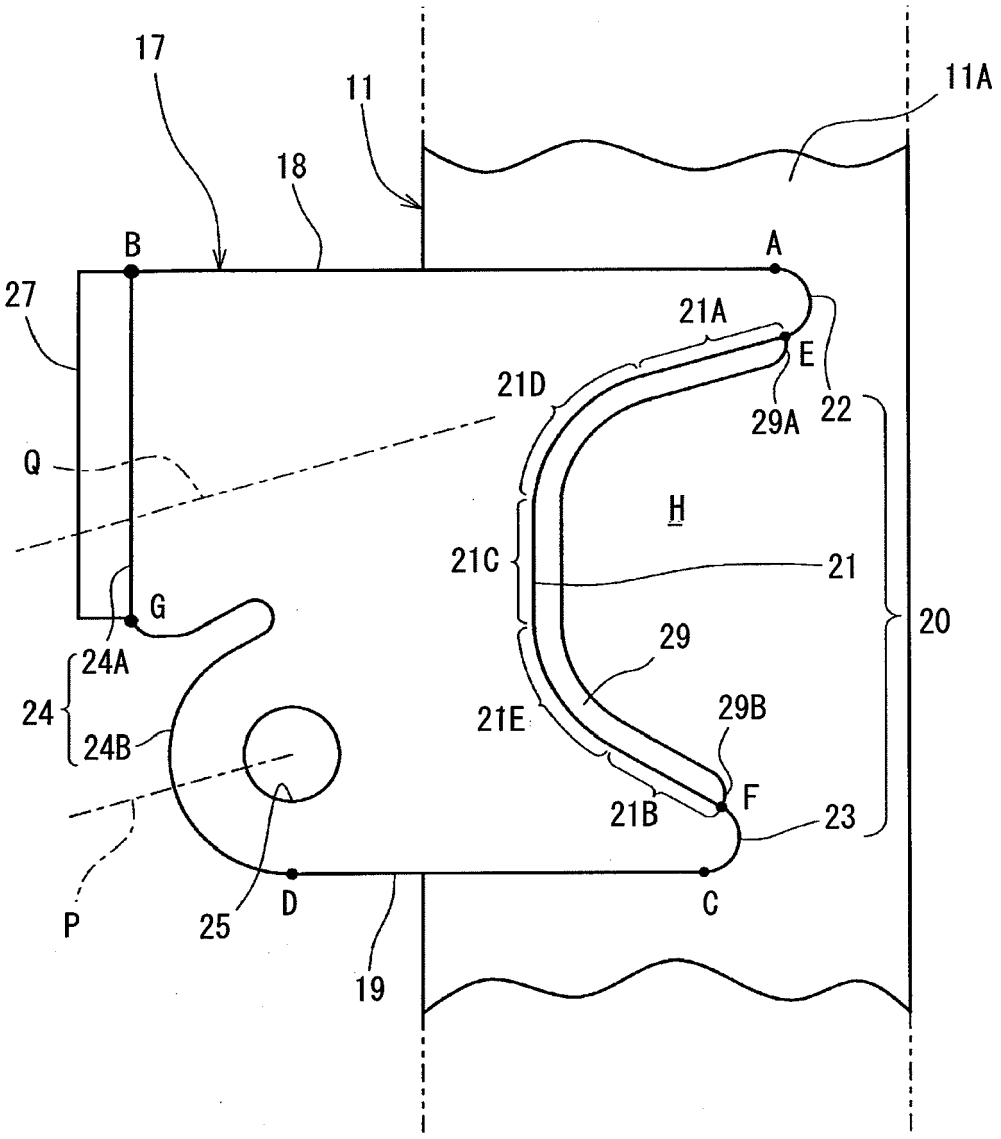
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FIG. 4

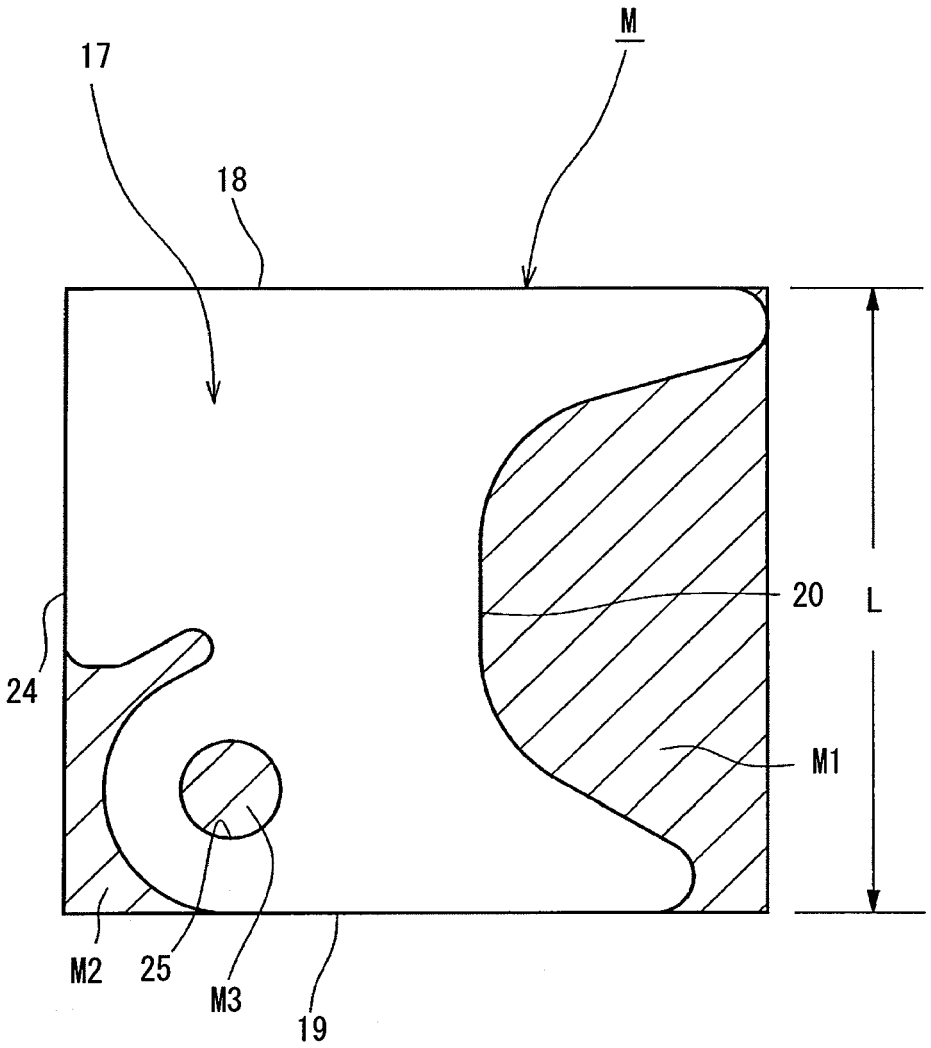
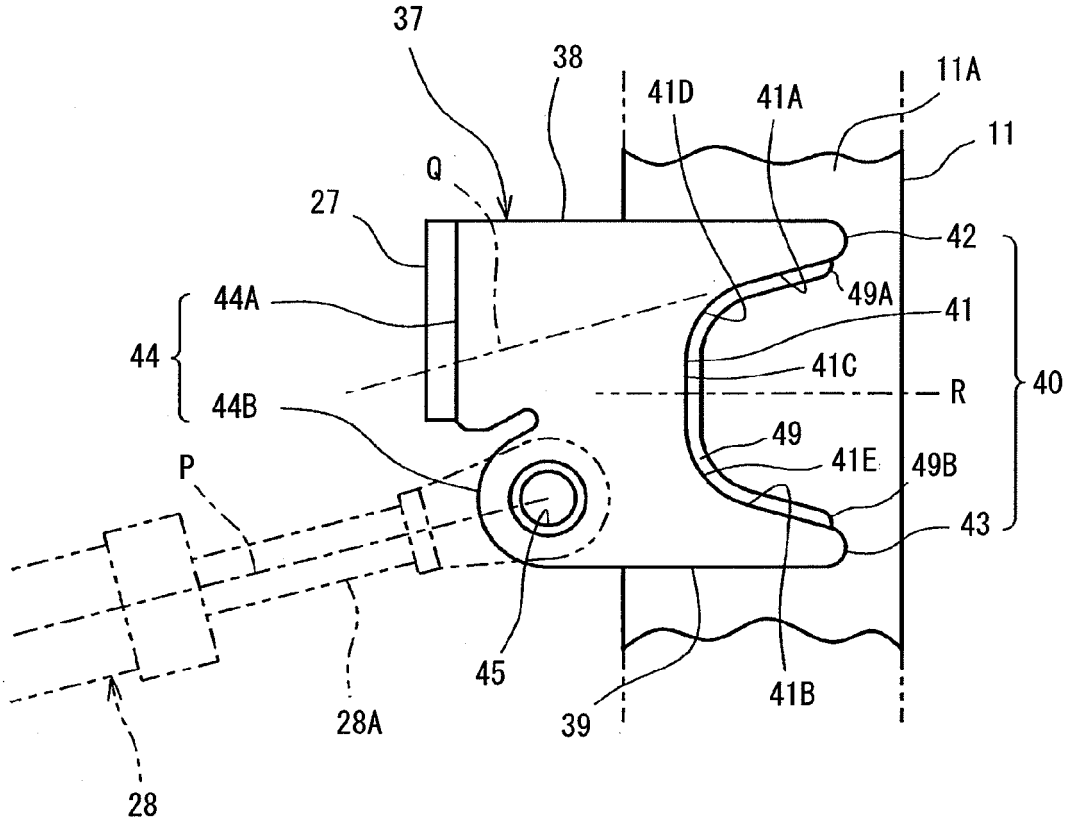


FIG. 5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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 4686

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 09 227095 A (TOYODA AUTOMATIC LOOM WORKS) 2 September 1997 (1997-09-02) * abstract * * figures 1-7 *	1-5	INV. B66F9/08
A	JP 2000 255996 A (KOMATSU FORKLIFT) 19 September 2000 (2000-09-19) * abstract * * figures 1-5 *	1-3,5	
A	JP 2000 016790 A (TOYODA AUTOMATIC LOOM WORKS) 18 January 2000 (2000-01-18) * abstract * * figures 1a-c *	1-3,5	
A	JP 05 338996 A (TOYODA AUTOMATIC LOOM WORKS) 21 December 1993 (1993-12-21) * abstract * * figures 1-3 *	1	
A	JP 2006 008315 A (TCM CORP) 12 January 2006 (2006-01-12) * abstract * * figures 1-7 *	1	TECHNICAL FIELDS SEARCHED (IPC) B66F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 December 2008	Rupcic, Zoran

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 16 4686

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16-12-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 9227095 A	02-09-1997	NONE	
JP 2000255996 A	19-09-2000	NONE	
JP 2000016790 A	18-01-2000	JP 3985347 B2	03-10-2007
JP 5338996 A	21-12-1993	NONE	
JP 2006008315 A	12-01-2006	NONE	

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4148799 A **[0002] [0004]**