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(71) Applicant : **BOSS TRUCKS LIMITED**
Grovebury Road
Leighton Buzzard, Bedfordshire LU7 8SR (GB)

(72) Inventor : **Bowman Shaw, Neville, Sir**
Toddington Manor,
Toddington, Bedfordshire (GB)
Inventor : **Clarke, James**
31 THe Paddocks,
Leighton Buzzard, Bedfordshire (GB)

(74) Representative : **Richards, David John et al**
PAGE, WHITE & FARRER 54 Doughty Street
London WC1N 2LS (GB)

(54) Load handling vehicles.

(57) A load handling vehicle has a lifting mast (10) and a carriage (12) incorporating load-handling means movable up and down the lifting mast. The carriage is movable on rollers (20, 20') which run inside the channel sections of the mast, and the pivot axles (52) of the rollers (20) on at least one side of the carriage (12) are eccentrically mounted on spigots (36) which are rotatable by means of a hydraulic cylinder (46) and associated actuating arms (38, 40). Rotation of the spigots (36) under the control of the vehicle operator causes a translational forwards or backwards movement of the rollers (20) relative to the carriage (12) and a corresponding slewing movement of the carriage relative to the vehicle, thereby enabling ready adjustment of the position of the load-engaging means (with or without a load thereon) relative to the vehicle.

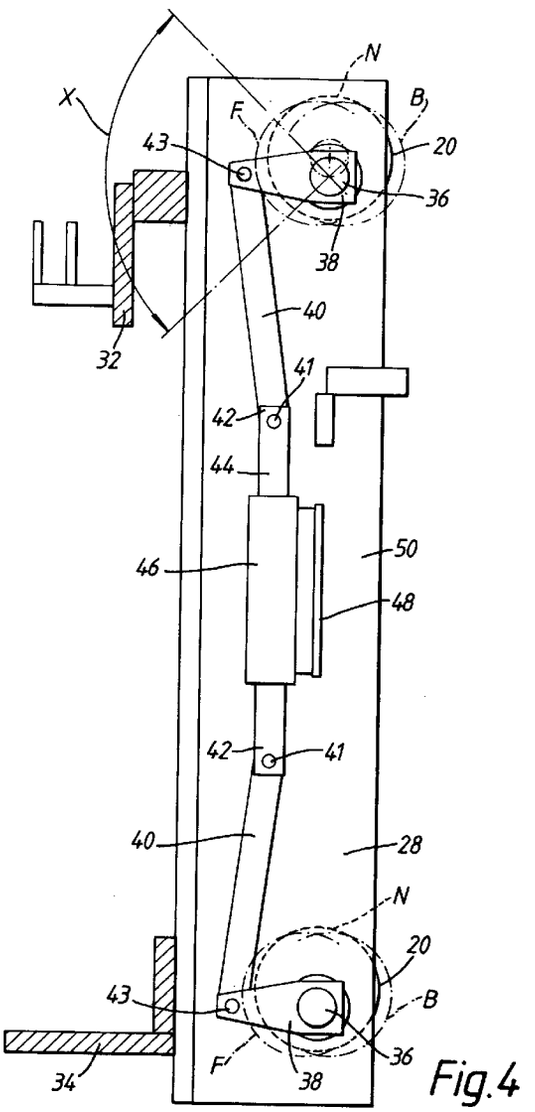

Fig.4

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The present invention relates to a load handling vehicle of the kind comprising a lift mast and a carriage movable up and down the mast, the carriage having mounted thereon a load engaging means.

Load handling vehicles of this kind are utilised in a wide variety of load handling applications with the load engaging means which is mounted on the carriage having a variety of different configurations depending upon the particular application of the load carrying vehicle. Such load handling vehicles may be designed to handle large freight containers and similar standardised loads which can be stored in a stack. For example, empty freight containers are frequently stored in stacks of up to eight containers high. When such containers are stacked, it is necessary that the containers are accurately aligned one above the other. When a load handling vehicle is being operated to place a container onto the top of the stack, it is essential that the container is accurately aligned both translationally and rotationally with the container underneath. In some known load handling vehicles this requires the operator of the vehicle accurately to align the entire vehicle relative to the stack and this can be a time consuming operation requiring the vehicle to be moved a number of times so as to locate the container squarely above the container underneath. This is a particular problem with very large containers, for example containers about 12 meters (40 feet) long, since a small rotational movement of the vehicle will cause a large rotational movement of the container.

It is known to provide a load handling vehicle in which one or more hydraulic cylinders are disposed between a carriage on the load handling vehicle and a load engaging means mounted thereon so as to cause the load engaging means to be slewed relative to the carriage. However, such a slewing system has limited application in that it cannot be employed with other types of mast mounted lifting carriages. Also it may require attachments to be made to the front of the carriage, causing an undesirable forward displacement of the load centre.

The present invention aims to provide a load handling vehicle which is capable of at least partly alleviating the problems in the prior art discussed hereinabove by providing a slewing system for a load handling vehicle which can be utilised in a wide variety of load handling applications and load handling vehicle constructions.

Accordingly, the present invention provides a load handling vehicle including a lifting mast, a carriage which is mounted for movement up and down the mast, the carriage incorporating or being adapted to mount thereon a load engaging means, a roller or slider assembly mounted on the carriage and received in the mast for movement therealong, and means for slewing the carriage relative to the mast about a substantially vertical axis.

Preferably, the roller or slider assembly comprises a plurality of rollers mounted on each upright side of the carriage and the slewing means comprises means for translationally moving the rollers forwards or backwards relative to the carriage on at least one upright side of the carriage.

More preferably, each translationally movable roller is eccentrically mounted on a spigot which is rotatably mounted in the carriage whereby rotation of the spigot causes eccentric translational movement of the roller mounted thereon.

Still more preferably, the slewing means includes a hydraulic cylinder assembly which is arranged to rotate each spigot.

Preferably, the hydraulic cylinder assembly is connected to each spigot by a respective operating arm fixed to the respective spigot and a link rod pivotally mounted to the piston of the hydraulic cylinder assembly and to the operating arm.

Optionally, two rollers are mounted on the said at least one upright side of the carriage and the hydraulic cylinder assembly is a double acting hydraulic cylinder which is arranged simultaneously to rotate both of the said two rollers.

Preferably, the carriage has mounted thereon load-engaging means such as a gantry or a side lift attachment for freight container handling.

Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:-

FIG. 1 is a schematic side view of a load handling vehicle comprising a lifting mast and incorporating a slewable carriage in accordance with an embodiment of the present invention;

FIG. 2 is a schematic plan view of a modification of the slewable carriage of Figure 1 having a load carrying attachment mounted thereon and handling a freight container, the container being shown in two relatively slewed positions;

FIG. 3 is a front view of the carriage of Figure 1 which is mountable between the mast uprights of the load handling vehicle;

FIG. 4 is a part sectional side view on line A-A of the carriage of Figure 3; and

FIG. 5 is a partly cut away plan view of a spigot in the carriage on which is mounted a respective roller of the carriage of Figure 4 and to which is attached an operating arm of the hydraulic cylinder assembly of Figure 3.

Referring to Figure 1, a load handling vehicle 2 comprises a chassis 4 supported on front and rear wheels 6,8. A telescopic lifting mast assembly 10, which may be of any known construction, such as a simplex, duplex, triplex or quadruple mast, is fitted to the chassis 4 and a carriage 12 is mounted between a pair of mast uprights 14 of the mast assembly 10 so as to be movable up and down the mast in known manner. A load engaging means 16, which in the illustrated embodiment of Fig. 1 is a pair of lifting forks,

is mounted on the carriage 12 for engaging and carrying a load (not shown). Although the load handling vehicle 2 has been illustrated with reference to lifting forks being mounted on a carriage, it will be immediately apparent to the man skilled in the art that the present invention has application to a wide variety of mast mounted carriages, for example fork carriages, gantrys for supporting containers, fork frames, carriages for supporting load engaging attachments, such as side lift attachments or front lift attachments, or any other mast mounted carriers.

Referring to Figure 2, this shows a carriage 12 (which is a modification of that shown in Figure 1) to which is mounted a load engaging means in the form of a freight container side lift attachment 18 instead of the lifting forks shown in Figure 1. The carriage 12 has mounted thereon a roller or slider assembly which in the illustrated embodiment comprises, on each vertical side of the carriage, a pair of vertically spaced rollers 20,20' which are free-rolling and are received in a respective channel 22 defined in each of the pair of mast uprights 14. The rollers may alternatively be replaced by sliders in the form of slider shoes. As is shown schematically in Figure 2, the carriage 12 is adapted to be slewed i.e. rotated about a substantially vertical axis relative to the mast 10, thereby to permit the load 24 carried by the load-engaging means 18 to be rotated relative to the mast 10. A slewed position of the load 24 is shown in phantom in Figure 2. For clarity of illustration the carriage 12 is not shown in its slewed position. However, the slewing causes at least one upright side of the carriage 12 to be moved towards or backwards relative to the mast 10. It will be apparent that a relatively small distance of rotational movement of the carriage 12 as a result of the slewing movement will cause a relatively large movement of the end of the load 24 when the load 24 is long, for example, when the load 24 is a freight container. This enables the load 24 readily to be correctly oriented in position by slewing movement of the carriage 12 rather than by movement of the entire vehicle 2. The construction and operation of slewing carriage 12 is described below in greater detail with reference to Figures 3 to 5.

Referring to Figure 3, the carriage 12 is, in the illustrated embodiment, of substantially rectangular form comprising a pair of horizontally spaced upright members 28,30 connected together by a pair of vertically spaced horizontal members 32,34. One of the upright members 28, in Figure 3 the left-hand upright member, carries one of the pairs of vertically spaced rollers 20 which are, in use, received in the channel 22 of one of the mast uprights 14. The other upright member 30 similarly carries the second pair of rollers 20' which are, in use, received in the channel 22 of the other mast upright 14. Each roller 20' of the second pair of rollers 20' is mounted for free rolling rotational movement on a fixed axle 35 carried on the upright member 30. Each roller 20 of the said one pair is mounted for free rolling rotational movement on a respective spigot 36 with the rollers 20 both being disposed on the outwardly directed vertical side 37 of the upright member 28. Each spigot 36 extends through and is rotatably mounted in the upright member 28. As is shown more clearly with reference to Figure 4, which is a part sectional view on line A-A of Figure 3, at the inwardly directed vertical side 39 of the upright member 28 each spigot 36 has an operating arm 38 mounted thereon. Each operating arm 38 is rotationally fixed relative to the respective spigot 36. Each operating arm 38 has pivotally mounted by means of a pivot joint 43 thereon a link rod 40 which in turn is pivotally mounted by means of a pivot joint 41 to a respective end 42 of a common piston 44 of a double acting hydraulic cylinder assembly 46, of known construction, which is mounted by a mounting device 48 to the inwardly directed surface 50 of the upright member 28 of the carriage 12. The pivot connections between the double acting hydraulic cylinder assembly 46 and the two operating arms 38 are of opposite rotational directions for each of the two spigots 36. Accordingly, movement of the piston 44 of the double acting hydraulic cylinder 46 under hydraulic control causes the piston 46 to move upwardly or downwardly in the direction of the mast 14 and thereby causes, respectively, either clockwise or anticlockwise rotation, with reference to Figure 4, of both of the spigots 36.

The construction of each spigot 36 is shown in greater detail in Figure 5. The spigot 36 includes at one end thereof a cylindrical portion 52 constituting an axle for carrying a respective roller 20. A shoulder portion 54 is adjacent to the cylindrical portion 52 and a thrust washer 56 is mounted on the spigot 36 between the shoulder portion 54 and the upright member 28. A second cylindrical portion 58, shown in phantom in Figure 5, extends through the upright member 28 and is rotatably supported therein by a pair of bushes 60,62 located on opposed sides of the upright member 28. The second cylindrical portion 58 constitutes an axle of the spigot 36 in the upright member 28. An end portion 64 for mounting an operating arm 38 thereto is spaced from the upright member 28 by a second thrust washer 66 and the operating arm 36 is fixed thereto. The operating arm 36 is rotationally fixed relative to the spigot 36 by a pin connection (not shown). Figure 5 also shows the pivot joint 43 between the operating arm 36 and the link rod 40, the hydraulic cylinder assembly 46 and the pivot joint 41 between the link rod 40 and the piston 44.

It will be seen from Figure 5 that the axis 68 of the cylindrical portion 52 for carrying the roller 20 which is free rolling in the channel 22 of the upright mast 14 is off-set relative to the axis 70 of the main cylindrical portion 58 of the spigot 36 which is mounted for rotational movement in the upright member 28. Thus the

spigot 36 is rotationally eccentrically mounted in the upright member 28 relative to the axis of rotation of the roller 20.

An example of the off-set distance between the common axis 68 of the roller 20 and the cylinder portion 52 and the axis of rotation of the spigot 36 is 21 mm. This eccentric mounting of the roller 20 on the spigot 36 in the upright member 28 enables the roller 20 to be moved by a camming-type action translationally forwards or backwards relative to the upright member 28 thereby to enable the carriage to be slewed relative to the mast.

The operation of the slewing system will now be described. The rollers 20' are translationally fixed relative to the upright 30 of the carriage 12. As is shown in Figure 5, each roller 20 mounted on the upright member 28 may be disposed in a neutral position (position N) with the axis 68 of the roller 20 being located vertically above the axis 70 of the spigot 36. In this orientation the carriage 12 is parallel to and aligned with the mast 10. Rotation of the spigots 36 by operation of the hydraulic cylinder assembly 46 acting through the link rods 40 and the operating arms 38 thereby causes the axis of both rollers 20 to be rotated relative to the axis of the spigot 36 so that the rollers 20 are both equally translated in a substantially horizontal direction fowardly or backwardly relative to the upright member 28 as a result of the eccentric mounting of the rollers 20 relative to the respective spigots 36. Figure 4 shows in phantom the rollers 20 both in their forward position (position F) and in their backward position (position B). Since the rollers 20 are held captive in the channel 22, translational movement of the rollers 20 relative to the carriage 12 causes the side of the carriage 12 carrying the rollers 20 to be moved forwards or backwards relative to the mast upright 14 thereby causing slewing of the carriage 12 on the mast 10. Such a camming-type action of the rollers 20 in the mast upright 14 enables the slewing position of the carriage 12 reliably and rapidly to be controlled by the operator. The total angular movement X shown in Figure 4 of each operating arm 38 between the forward and backward positions of the rollers 20 is preferably 90°. This corresponds to an angular movement of the operating arms 38 of +/- 45° about the neutral position of the operating arm 38. As described above, in the preferred embodiment this coresponds to +/- 21 mm forwards and backwards movement of the upright member 28 of the carriage 12 relative to the mast upright 14. As is shown with reference to Figure 2, for a 12 meter (40 foot) long container which is carried by an attachment on the carrier 16, this corresponds to a slew at the ends of the container of +/- 150 mm (represented by the distance d in Figure 2).

Thus the present invention provides an elegant and simple construction for enabling slewing of a carriage in a mast of a load carrying vehicle.

In the illustrated embodiment, although a hydraulic cylinder assembly 46 is employed to drive the operating arms 38, it will be readily understood by the man skilled in the art that other driving devices can be employed instead of a hydraulic cylinder assembly. Furthermore, the illustrated embodiment enables the carriage to be slewed by translational movement of one side of the carriage relative to the mast whilst the other side of the carriage remains translationally fixed relative to the mast. In accordance with the present invention it would be possible to provide an eccentric roller assembly on both sides of the carriage. This would provide the advantage that greater slewing of the load could be achieved at small translational movements of individual rollers.

Although the present invention has been illustrated with reference to a load carrying vehicle having a mast-mounted carriage in the form of a fork frame which carries forks, the present invention has application in the provision of a slewable mast-mounted carriage for a wide variety of uses. Thus the present invention could be used on general purpose load carrying vehicles which employ a set of forks, in container handling wherein a top lift attachment is mounted on forks or a side lift attachment is mounted on the carriage. The present invention could also be used in conjunction with a carriage in the form a gantry for container handling. The carriage may be a fork carriage or a fork frame or any other mast mounted carrier which is mounted between the mast uprights. Further, the present invention has particular application in handling of particularly long loads, for example empty freight containers. It will be apparent to the man skilled in the art that the provision of a slewing facility for a load handling vehicle provides advantages over known load handling vehicles in a wide variety of applications.

Furthermore, although the present invention has been illustrated with reference to a lifting mast in which rollers carried on a carriage move in channels up and down the mast, in accordance with the invention a slider assembly may be provided instead of the roller assembly. The slider assembly includes sliders or shoes which are mounted on the carriage and are arranged to slide up and down the channels in the mast, at the same time being translationally movable in a manner similar to the rollers shown herein.

Claims

1. A load handling vehicle including a lifting mast (10), a carriage (12) mounted for movement up and down the mast, the carriage incorporating or being adapted to mount thereon a load engaging means (16, 18), a roller or slider assembly (36) mounted on the carriage and received in the mast for movement therealong, and means (36,

40, 46) for slewing the carriage relative to the mast about a substantially vertical axis.

2. A load handling vehicle according to claim 1, wherein the roller or slider assembly comprises a plurality of rollers (20, 20') mounted on each upright side (28, 30) of the carriage and the slewing means comprises means (38, 40, 46) for translationally moving the rollers forwards or backwards relative to the carriage on at least one upright side (28) of the carriage.

3. A load handling vehicle according to claim 2, wherein each translationally movable roller (20) is eccentrically mounted on a spigot (52) which is rotatably mounted in the carriage whereby rotation of the spigot (52) causes eccentric translational movement of the roller (20) mounted thereon.

4. A load handling vehicle according to claim 3, wherein the slewing means includes a hydraulic cylinder assembly (46) which is arranged to rotate each spigot (52).

5. A load handling vehicle according to claim 4, wherein the hydraulic cylinder assembly (46) is connected to each spigot (52) by a respective operating arm (38) fixed to the respective spigot and a link rod (40) pivotally mounted to the piston of the hydraulic cylinder assembly and to the operating arm.

6. A load handling vehicle according to claim 4 or claim 5, wherein two rollers (20) are mounted on the said at least one upright side (28) of the carriage and the hydraulic cylinder assembly (46) is a double acting hydraulic cylinder which is arranged simultaneously to rotate both of the spigots (52) supporting said two rollers (20).

7. A load handling vehicle according to any foregoing claim, wherein the carriage comprises a gantry.

8. A load handling vehicle according to claim 7, wherein the carriage has mounted thereon a side lift attachment for freight container handling.

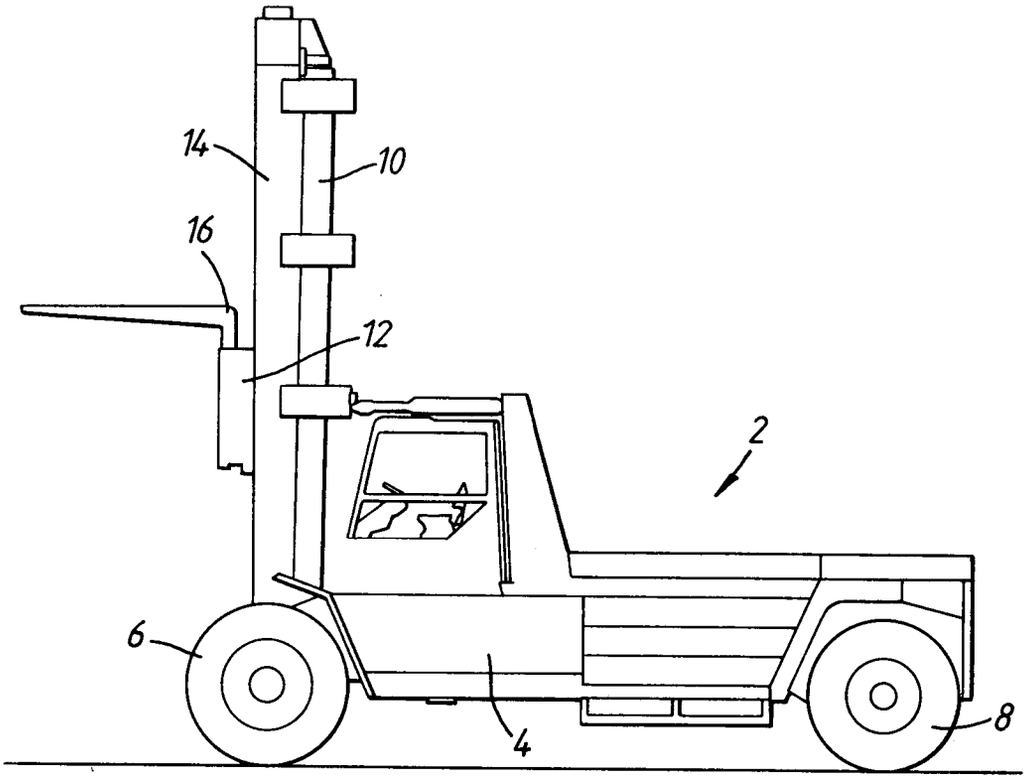

Fig.1

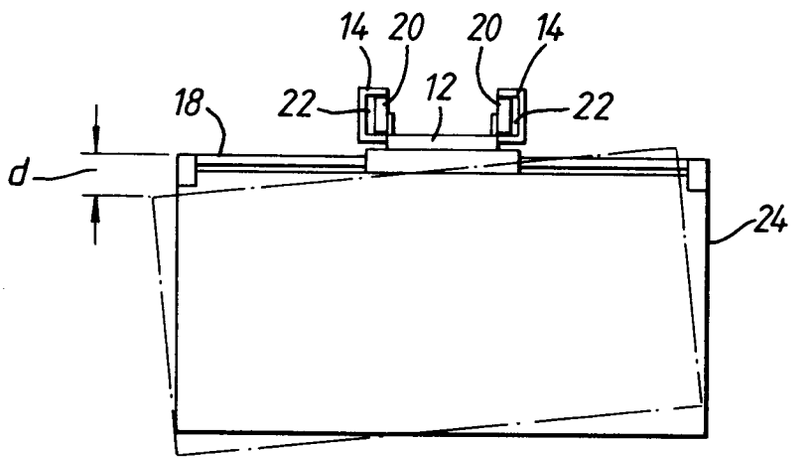

Fig.2

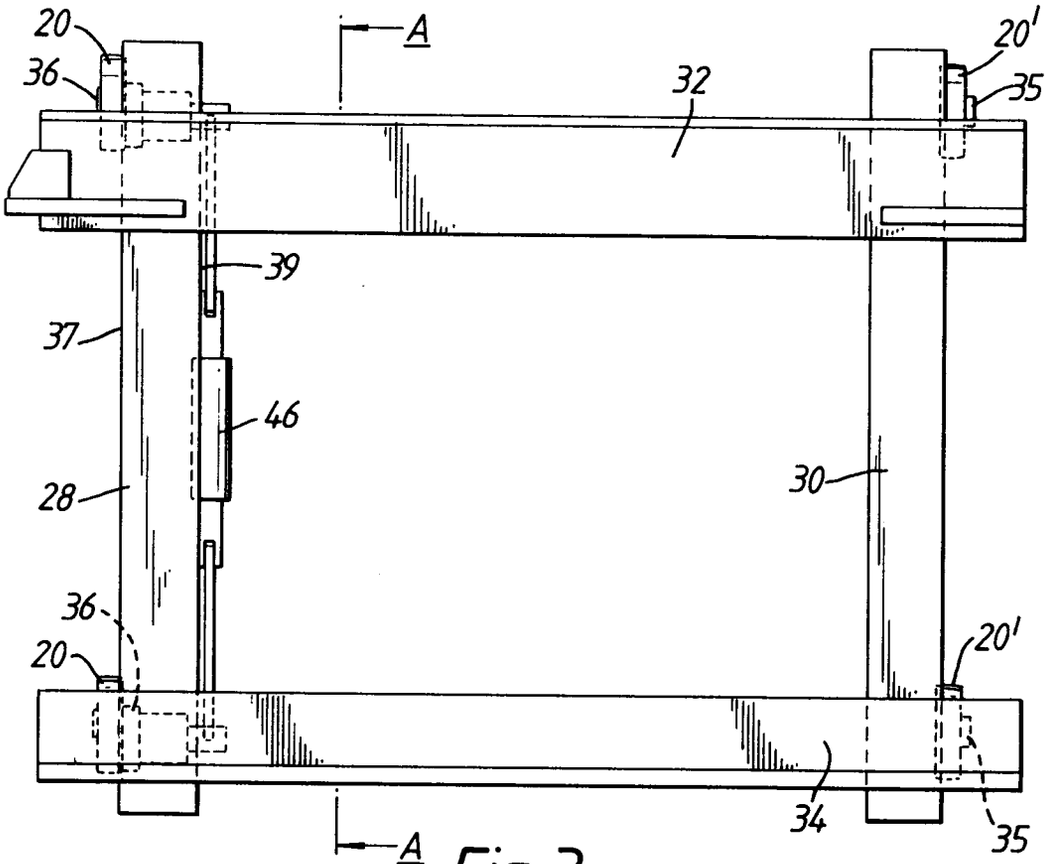
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Fig.3

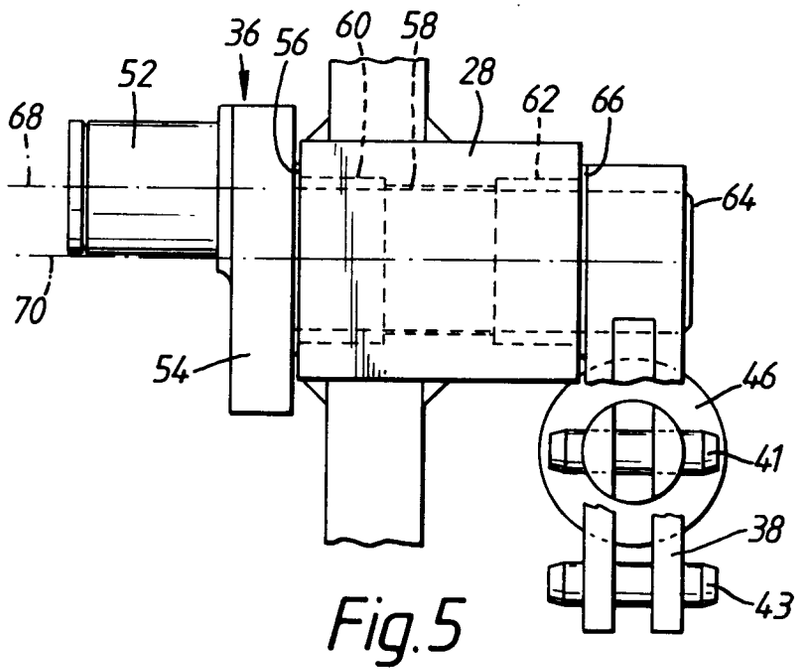
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Fig.5

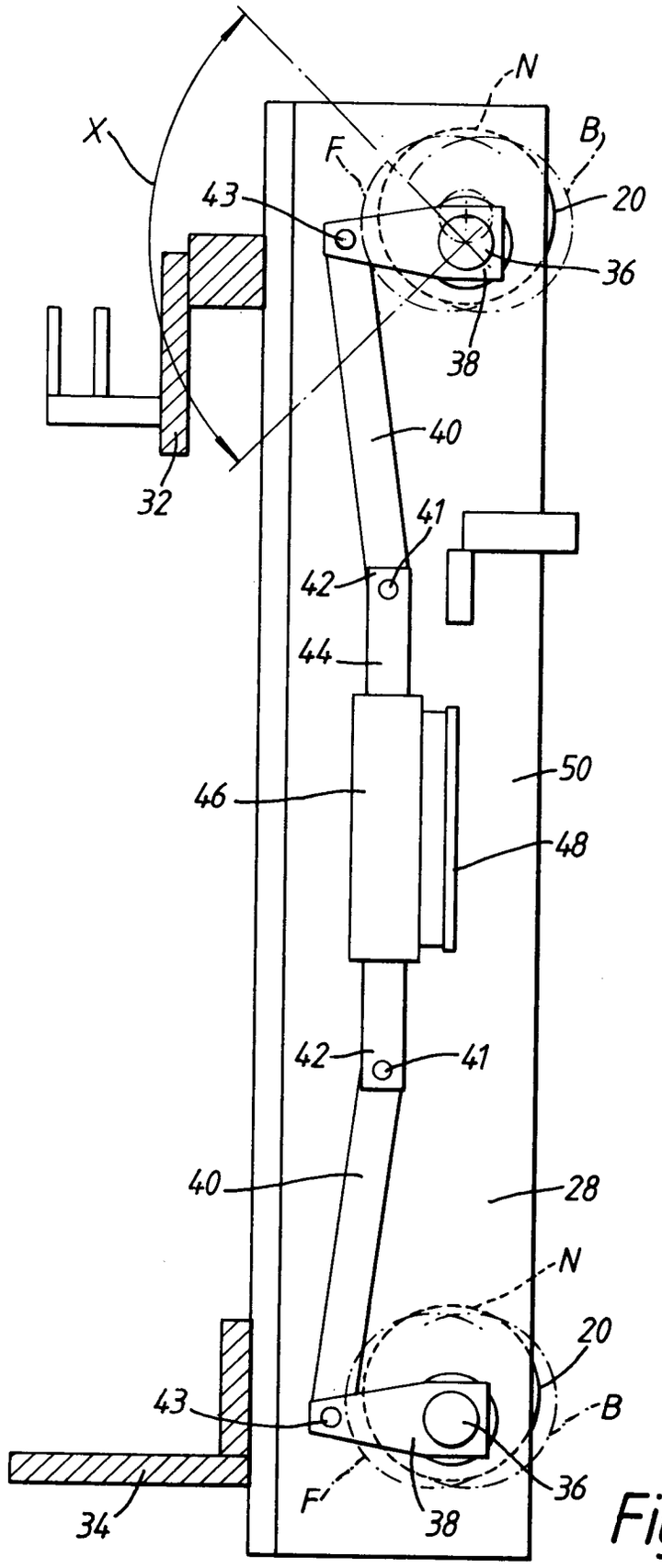

Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 8552

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X Y	US-A-2 059 150 (SCHROEDER) * page 2, left column, line 18 - line 51 * * page 2, right column, line 67 - page 3, left column, line 26 * ---	1-3 7,8	B66F9/08 B66F9/18
Y	GB-A-1 423 513 (LANCER BOSS GROUP) * page 2, line 41 - line 107 * ---	7,8	
A	FR-A-2 537 120 (MANITOU) ---		
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A	US-A-3 083 853 (HASTINGS) ---		
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A	FR-A-1 038 163 (COMP. GÉNÉRALE DE CONSTRUCTION DE LOCOMOTIVES BATIGNOLLES - CHÂTILLON) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.5) B66F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 January 1994	Van den Berghe, E

CATEGORY OF CITED DOCUMENTS

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