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(71) Applicant : **IMMOBILIARE VARCAS S.P.A.**
Via del Rondone, 3
I-40122 Bologna (IT)

(72) Inventor : **Regazzoni, Carlo**
Via Colliva, 4
I-40037 Sasso Marconi (Bologna) (IT)

(74) Representative : **Lanzoni, Luciano**
c/o BUGNION S.p.A.
Via dei Mille, 19
I-40121 Bologna (IT)

(54) An improvement to a rail car for the carriage and transportation of commercial road vehicles.

(57) In the improved transporter car, the cradle (4) rotates on a virtual fifth wheel (RV) composed of a non-loadbearing kingbolt (10), coinciding with a barycentrically located vertical axis (X), by which the cradle (4) is anchored to a fixed structure (6) with the freedom to rotate about the axis, and a plurality of wheels (11a, 11b) mounted between the bottom face of the cradle (4) and the top face of the fixed structure, typically a pair of beams (6a, 6b) ; the wheels describe arcs of rotation centred on the axis (X), and are spaced in such a way as to create a turntable of generous diameter capable of affording rigid support to a broad expanse of the cradle when the beams (6a, 6b) beneath are elevated and flexed. The cradle (4) is also equipped with stabilizer wheels positioned at each end, which are lowered onto the ground when the cradle is rotated into the loading and offloading position so as to keep the structure of the cradle properly balanced and essentially parallel with the surface beneath.

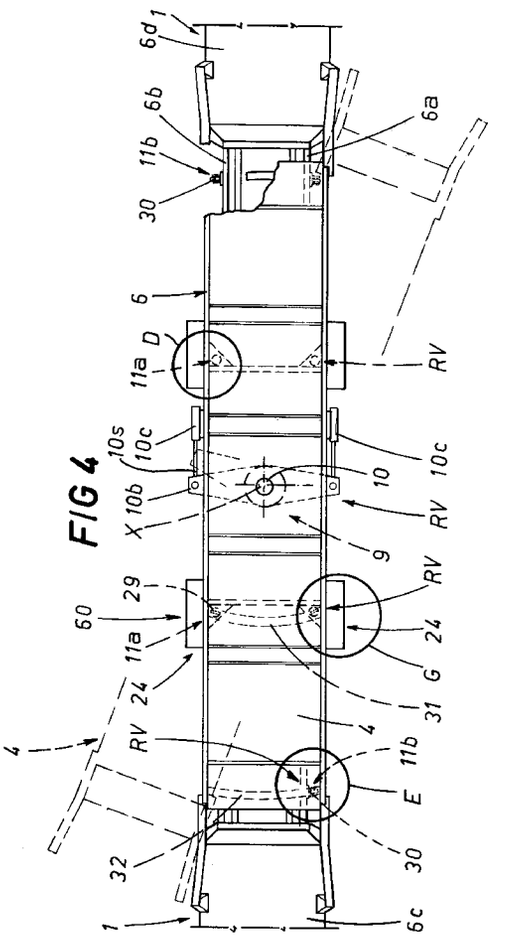

FIG 4

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The present invention relates to an improvement in a rail car of the type utilized for carrying and transporting commercial road vehicles.

There is by now a widespread awareness of the ever present and severe problem inherent in the threat to safe, high-speed travel on roads and motorways posed by the large number of heavy goods vehicles (typically TIRs) currently in circulation.

One attempt at alleviating this situation in some measure has been to promote the idea (not least by legislating to prohibit circulation on the highway at certain times), that vehicles of the type in question could be transported by rail, especially when scheduled for the most part simply to transit non-stop across given territories or countries.

In this context, the same applicant has already filed a specification (Application n° 3568A/90 for Italian patent) disclosing a rail car essentially comprising a number of basic assemblies carried by a pair of standard rail bogies, namely:

- a fixed structure consisting in a pair of parallel beams interconnecting two flat car bodies mounted each by way of a spherical bearing to the relative bogie;
- a movable cradle structure of rigid embodiment stably accommodating a road vehicle, such as can be positioned on and anchored to the flat car body at each end; also elevating means positioned centrally beneath and permanently associated with the cradle, by which the cradle structure itself can be raised from the bogies and the rails;
- means interposed between the cradle structure and the elevating means, by which the cradle can be rotated about a vertical axis, coinciding with its centre of mass, from an inboard carrying position of longitudinal alignment with the fixed structure to an outboard load/offload position, angled away from the fixed structure;
- interlocking means designed to interact between the cradle structure and the longitudinal members of the fixed structure when the cradle is raised from the transport position to the inboard elevated position, in such a way as to flex the longitudinal members and thus distance the flat car bodies from one another.

This type of solution allows a road haulage vehicle to be loaded and offloaded simply and swiftly, and without any requirement for special infrastructures to be incorporated into the goods yard (other than a platform elevated to the level of the rotating structure so that the vehicle can roll on or off); the embodiment of the cradle structure also permits of accommodating a variety of loads according to the needs of the moment (single semitrailer without tractor, two or more tractors, a number of medium and small capacity trucks, etc.).

Research and design work on the car in question was followed in the conventional manner by realization and construction, and ultimately by field trials; in the course of such trials, it was observed that the means allowing rotation of the cradle, embodied as a central slewing ring which in practice would also bear the full weight of the cradle, were not sufficiently able both to sustain the static weight of the structure (i.e. during transportation by rail) and to maintain horizontal alignment during rotation when loading and offloading; in effect, a single centrally located bearing albeit generously proportioned can cause the cradle to function in a defective manner, for example tipping excessively during rotation with the attendant risk of damage to the overall structure. Moreover, the solution itself is typified by not inconsiderable weights and dimensions.

Accordingly, the object of the present invention is to overcome the drawbacks briefly outlined above by improving a transporter rail car for commercial road vehicles of the type in question, in such a way that the cradle can be manoeuvred more easily and swiftly, and made safer and more stable both when loading or offloading and when in transit on the track with vehicles loaded.

The stated object is realized in the improvement to which the present invention relates.

The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

- fig 1 illustrates a part of the improved rail car according to the present invention, seen in a side elevation;
- fig 2 is an enlarged side elevation of detail "A" in fig 1, with certain parts omitted and others illustrated in section, which shows interlocking means forming part of the improvement to which the invention relates;
- fig 3 is an enlarged side elevation of detail "B" in fig 1, with certain parts omitted and others in section, which shows further interlocking means and stabilizing means;
- fig 4 affords a schematic representation of the improved rail car according to the invention, seen in plan from above;
- figs 5 and 5a are views of detail "D" in fig 4, enlarged in plan from above and in side elevation, respectively, and with certain parts omitted, which show one element of a virtual fifth wheel in the improved rail car disclosed;
- figs 6 and 6a are views of detail "E" in fig 4, enlarged in plan from above and in side elevation, respectively, and with certain parts omitted, which show a further element of the virtual fifth wheel in the improved rail car disclosed;
- fig 7, which shows detail "G" of fig 4 in plan from above, enlarged and with certain parts omitted better to reveal others, illustrates a part of the elevating means in the rail car dis-

closed;

- figs 8, 9, 10 and 11 show successive steps in the rotational movement described by the movable cradle structure of the improved car, viewed schematically in plan from above.

With reference to the accompanying drawings, the improvement disclosed relates to a rail car used for carrying and transporting road haulage vehicles or commercial vehicles generally (denoted 5 in the drawings).

The car consists essentially in a number of basic assemblies (indicated in fig 1, which shows one end of the car only given that the overall structure is substantially symmetrical in relation to a vertical plane), namely:

- a pair of standard bogies 1 running on rails 3, and a fixed interconnecting structure 6 comprising a pair of parallel beams 6a and 6b disposed in a common plane above the rolling plane of the bogies and connected at the respective ends to a pair of flat car bodies 6c and 6d concurrent each with the deck of the corresponding bogie 1;
- a rigid, movable bearing structure 4 of cradle embodiment stably accommodating the road vehicle 5, furnished with arms 4a at each end and capable thus of resting on the flat car bodies 6c and 6d;
- elevating means 7 serving to raise the cradle structure 4 off the bogies 1, positioned centrally and beneath the cradle structure and capable thus of controlled movement between two limit positions, namely at-rest and operative, in which the means 7 themselves are respectively compassed within the vertical dimensions of the car, and extended beyond the compass of the selfsame vertical dimensions to the point of making contact with a datum surface P beneath;
- means 9, actuated via an external control when the elevating means 7 are in the operative position, by which the cradle structure 4 is caused to rotate about a barycentrically located vertical axis X between an inboard position substantially within the dimensional compass of the two bogies 1, viewed in plan, and an outboard position projecting beyond the selfsame dimensional compass of the bogies 1, viewed in plan, in which the vehicle 5 can roll on and roll off;
- means 60 by which to interlock the movable cradle structure 4 and the beams 6a and 6b of the fixed structure, brought into operation concurrently with the ascent of the cradle to the elevated position in such a manner as to raise and flex the beams 6a and 6b, thereby distancing the flat car bodies 6c and 6d one from another and increasing the internal clearance allowed to the cradle in the longitudinal direction.

In the interests of simplicity, certain elements mentioned above will not be illustrated in full, as neither are others typically included though of a non-essential character, being either conventional in embodiment or already described extensively in Italian Patent Application 3568A/90 aforementioned.

In particular, the improvement disclosed relates to the rotation means 9 mentioned above: such means consist in a virtual fifth wheel denoted RV in its entirety (see figs 4, 5 and 5a, 6 and 6a), which comprises a non-loadbearing kingbolt 10 stably interposed between the fixed structure 6 and the movable rigid cradle.structure 4 and coinciding with the barycentric vertical axis X, by which the two structures 4 and 6 are interconnected and about which the cradle structure 4 is rotatable through the agency of power transmission means consisting preferably in a pair of hydraulic actuators located between the kingbolt 10 and the fixed structure 6 (the actuators in question, denoted 10c, are shown schematically in the drawings, being conventional in embodiment). As discernible clearly from fig 4, each of the hydraulic actuators 10c is anchored by the rear end to the outermost part of the relative beam 6a and 6b, and connected by its rod 10s to one corresponding end of a horizontal arm 10b rigidly associated with the kingbolt 10.

Also forming part of the improved rotation means 9, operating in conjunction with the kingbolt 10, are a plurality of rolling elements 11a and 11b freely interposed between the base of the cradle 4 and the plane occupied by the top faces of the beams 6a and 6b, tangential to the vertical axis X of rotation, of which the function is to provide the cradle with a turntable of generous diameter (notwithstanding the kingbolt 10 is non-loadbearing and of minimal proportions) such as will allow a rigid bearing surface R of the cradle 4 to settle on the pair of beams 6a and 6b during the elevating movement when the beams themselves are flexed: accordingly, the diameter of the virtual fifth wheel thus created is equivalent to the distance separating the rollers farthest from the kingbolt in opposite directions.

Still referring to fig 4, figs 5-5a and figs 6-6a, the plurality of rolling elements 11 comprises at least two sets of four freely rotatable wheels, a first set 29 spaced diametrically closer to and a second set 30 spaced diametrically farther from the vertical axis X. The wheels of the first set 29 are associated by way of bolts 36 each with a relative plate 29p welded to the underside of the moving cradle 4, and arranged two on either side of the vertical axis X of rotation in such a way as to roll in a corresponding pair of arcuate channels 31 afforded by the two beams 6a and 6b.

The wheels of the second set 30 are located in a plane beneath the cradle 4 coinciding substantially with the pair of beams 6a and 6b, again associated by way of bolts 37 each with a relative plate 30p, in this

instance welded to the external face of the corresponding beam; more exactly, the four wheels of the set 30 are arranged two at each end of the fixed structure 6, freely engaging a second pair of arcuate channels 32 afforded by the underside of the moving cradle 4.

The cradle structure 4 is equipped further with stabilizing means 21 capable of vertical movement, positioned at each end and in such a manner as to interact with an adjacent hardstand C whenever the cradle is rotated into the outboard or load/offload position, thereby ensuring that the cradle itself is balanced and maintained substantially parallel to the datum surface P.

More exactly, and as discernible in particular from figs 1 and 3, such stabilizing means 21 consist in pairs of hydraulic actuators 33 coinciding singly with the four corners of the cradle 4, each secured by one end to the rigid cradle structure, or rather to the respective arm 4a, by screw means 34. The remaining end of the single actuator 33 carries a freely revolving wheel 35 angled so as to roll on a line tangential to the vertical axis X of rotation and capable of movement thus (see arrow F, fig 3) between two limit positions: a non-operative raised position assumed in the inboard configuration, in which the wheel 35 is disposed within the vertical compass of the cradle structure 4, and an operative lowered position of contact with the hardstand C (shown by phantom lines in fig 3), assumed when the cradle 4 is rotated from the inboard configuration to the outboard or load/offload position.

The freely revolving wheel 35 is associated in turn with a vertically disposed lateral rod 40 extending parallel to the axis of the actuator 33, externally of the relative barrel, which is secured to the flange of a mounting bracket 35b and slidable thus in a vertical direction together with the wheel 35 in such a manner that the wheel will be held in the tangential position and prevented from swivelling about a vertical axis when rolling in contact with the hardstand C.

The improved car also comprises second interlocking means 12 positioned to operate between the fixed structure 6 and the movable cradle structure 4 when in the inboard configuration, at points both on the underside of the cradle 4 at each end and where the arms 4a come to rest on the flat car bodies 6c and 6d of the respective bogies 1, in such a way as to restrain the cradle 4 longitudinally and laterally in relation to the fixed structure 6.

In the example of the drawings (see figs 2 and 3), these second interlocking means 12 are shown as first and second sets of four hydraulic actuators, denoted 13 and 14 respectively. In the case of the first set 13, each of the four individual actuators is secured by way of screw means 15 to the fixed structure 6, horizontally disposed and directed toward a corresponding bottom face of the cradle 4, and extendible (arrow F1 in fig 3) to an operative position in which a tapered bolt 16 afforded by the free end portion of the relative rod 20 is caused to locate in a matching and correspondingly placed first socket 17 afforded by the cradle 4; in the case of the second set 14, each individual actuator is secured vertically to a respective arm 4a of the cradle 4, substantially at the farthest extremity, and extendible thus to an operative position in which the tapered bolt 16 locates in a matching second socket 18 afforded by the respective flat car body 6c or 6d.

The single hydraulic actuators of both sets 13 and 14 are equipped at the end remote from the tapered bolt 16 with safety spring means 19 impinging in the axial direction on the relative rod 20 in such a way as to maintain the bolt 16 in the extended operative position in the event that the hydraulic system (denoted 41) should be less than totally efficient in operation (e.g. leakage of oil from the cylinder), and capable also of holding the bolt in a non-operative retracted position. In effect, such spring means 19 consist in a conventional coil spring ensheathing a pin 42 rigidly associated with the rod 20, of which the opposite ends are retained respectively by the rod itself and by an end cap 43 constituting part of an external casing 44 in which each of the single actuators is housed.

As discernible from figs 4 and 7, the elevating means 7 are mounted to the pair of beams 6a and 6b at points near to the vertical axis X, and consist in four mutually opposed pairs of cylinders 22 and 23 of which first outer ends are anchored pivotably to separate points of a load bearing platform 24 (constituting the first interlocking means 60) associated transversely with the beams 6a and 6b and with the kingbolt 10 at centre; the remaining ends of each pair of cylinders are anchored jointly to a single foot 25 destined to enter into contact with the datum surface P, which in practice will be afforded by the railway track 3.

In the at-rest position, each pair of cylinders 22 and 23 is accommodated in a respective recess 26 afforded by the platform 24, which comprises two pairs of horizontal. and parallel brackets 27 and 28 secured to the relative beam 6a and 6b outside the dimensional compass of the fixed structure 6, the pairs of single cylinders 22 and 23 being disposed coaxially between the horizontal brackets 27 and 28 (as shown in fig 7). The platform 24 thus performs a dual role, functioning both as a component of the elevating means 7 and as first means 60 by which the cradle 4 and fixed structure 6 are interlocked.

The operation of the improved transporter rail car is shown schematically in figs 8 to 11. The car is drawn up alongside a shed (or indeed in any given space suitable for manoeuvring the road vehicle), and the brake applied; a function is then selected at a control unit (conventional in embodiment and therefore

not illustrated, but a normal centralized unit performing a programmed sequence of steps) to enable rotation of the cradle 4 in the appropriate direction, whereupon the tapered bolts 16 are drawn back from the respective sockets 17 and 18 to the retracted non-operative position in such a way that the cradle 4 is left resting freely on the flat car bodies 6c and 6d of the bogies 1 (see fig 8). At this juncture, the elevating means 7 are activated, with the result that the entire fixed structure 6 is raised together with the cradle 4 by the pairs of cylinders 22 and 23 and supported thus with the four feet 25 planted firmly on the datum surface P.

Clearly, the cradle structure 4 continues to be supported stably by the beams 6a and 6b thanks to the presence of the rolling elements 11a and 11b.

As the platform 24 (which, to reiterate, coincides with the first interlocking means 60) also impinges on the beams 6a and 6b and the cradle structure 4 during the passage from the transport position to the elevated position, the resulting mechanical interference causes the beams 6a and 6b to flex, distancing the flat car bodies 6c and 6d one from another and increasing the internal dimensions of the car in the longitudinal direction.

The actuators 10c of the rotation means 9 are now operated to swing the cradle structure 4 on its centre axis X through an angle of approximately 30° from the longitudinal axis of the car. The cradle 4 remains actively supported by all eight wheels of the two sets 29 and 30 during the first few degrees of rotation, whereupon the increasing divergence between the cradle 4 and the fixed structure 6 (see arrow F2, fig 9) results in the wheels successively losing contact, two by two, until only two are left in a supporting position diametrically opposed on either side of the kingbolt 10 (see figs 9, 10 and 11, in which the active wheels are shown as dots, and the inactive wheels as circles).

The actuators 33 of the stabilizing means 21 will also come into operation during the rotation, and with the relative wheels 35 grounded, the cradle 4 is maintained parallel with the hardstand C during rotation. As the cradle finally reaches the angled position, ramps are lowered to allow the vehicle to roll on or off as the case may be (a routine step for any transporter system which is therefore not illustrated).

With loading or unloading completed, the steps thus far described are repeated in reverse to return the cradle 4 to the inboard position, terminating with insertion of the bolts 16 in the relative sockets.

In practical application, all of the aforementioned moving parts involved in successive operating steps will be interlocked to a pneumatic control system (i.e. each component connected by a special valve) connected in turn to the air braking system of the rail car; accordingly, even in the event that just one component should fail to return to its correct position, the brake release function will remain inhibited.

As a result of the improvement thus described, the rail car is rendered notably more stable during all manoeuvring steps involving the cradle:

- a virtual fifth wheel of generous diameter is able to react to the mass (unevenly distributed) of the transported road vehicle while allowing continuous adaptation of the cradle to the changing geometry of the fixed structure when in deflection, thereby ensuring a correct rotation of the cradle whatever the layout of the track beneath;
- stabilizers with wheels ensure that the cradle is kept steadily balanced during roll-on and roll-off operations, when the distribution of masses can be markedly uneven;
- the second interlocking means are arranged in such a way that the two sets of hydraulic actuators and tapered bolts will ensure the necessary lateral restraint while allowing a measure of longitudinal and vertical movement respectively, the relative splayed sockets readily accommodating any elastic deformation occasioned in the structure of the car by variations in load.

Claims

1) An improvement to a rail car for carrying and transporting road haulage vehicles or commercial vehicles generally, of the type comprising a pair of bogies (1) running on rails (3), and interposed between the two bogies:

- a fixed structure (6) consisting in at least one pair of beams (6a, 6b) disposed mutually parallel in a common plane substantially coinciding with the plane occupied by the bogies (1) of which the ends are associated with respective flat car bodies (6c, 6d) connected each to a corresponding bogie (1), in such a way that the two bogies are interconnected;
- a rigid, movable bearing structure (4) of cradle embodiment stably accommodating the road vehicle (5), furnished with arms (4a) at each end and able thus to rest on the flat car bodies (6c, 6d);
- elevating means (7) serving to raise the cradle structure (4) off the bogies (1), located centrally and beneath the cradle structure and capable thus of controlled movement between at least an at-rest limit position, substantially compassed within the overall dimensions of the rail car and exhibiting a configuration of minimum height, and an operative elevating limit position substantially outside the dimensional compass of the rail car, exhibiting an extended configuration and engaged in contact

with a datum surface (P) beneath;

- rotation means (9) actuated by an external control when the elevating means (7) are in the operative position, by which the cradle structure (4) is made to swing about a barycentrically located vertical axis (X) between an inboard position substantially within the overall dimensional compass of the two bogies (1), and an outboard position projecting beyond the dimensional compass of the bogies (1), in which a vehicle (5) can roll on and roll off;
- interlocking means (60) by which to restrain the movable cradle structure (4) and the beams (6a, 6b) of the fixed structure one against another, brought into operation concurrently with the movement of the cradle to the elevated position in such a way as to raise and flex the beams (6a, 6b), thereby distancing the two flat car bodies (6c, 6d) one from another and increasing the relative internal clearance in the longitudinal direction,

characterized

- in that rotation means (9) consist in a virtual fifth wheel (RV) comprising a non-loadbearing kingbolt (10) stably interposed between the fixed structure (6) and the movable cradle structure (4) and coinciding with the barycentric vertical axis (X), thereby connecting the two structures (4, 6) while allowing the cradle (4) to rotate in response to the action of power transmission means impinging on the kingbolt (10), also a plurality of rolling elements (IIa, IIb) freely interposed between the bottom face of the cradle (4) and a plane occupied by the top faces of the beams (6a, 6b), disposed tangentially to the vertical axis (X) of rotation, of which the function is to provide a turntable of generous diameter and thus allow a rigid bearing surface of the cradle (4) to settle on the pair of beams (6a, 6b) during the elevating movement when the beams are flexed; and,
- in that the cradle structure (4) is equipped with stabilizing means (21) capable of movement in a vertical direction, positioned at each end of the structure and in such a way as to interact with the datum surface (P) whenever the cradle is rotated to the outboard position, thereby ensuring that the cradle itself remains balanced and substantially parallel to the datum surface (P).

2) An improvement as in claim 1, wherein the cradle structure (4) and the fixed structure (6) are mutually restrained in the inboard configuration by second interlocking means (12) operating between the bottom faces of the cradle (4) at each end and the corresponding part of the fixed structure (6), and between the arms (4a) of the cradle and the relative flat car bodies (6c, 6d), in such a way as to pin the cradle (4) longitudinally and vertically to the fixed structure (6).

3) An improvement as in claim 2, wherein the second interlocking means (12) comprise:

- a first set of four hydraulic actuators (13), each secured by way of screw means (15) to the fixed structure (6), horizontally disposed and directed toward a corresponding face of the cradle (4) and extendible to an operative position in which a tapered bolt (16) afforded by the free end of the relative rod (20) is caused to locate in a matching and correspondingly positioned first socket (17) associated with the cradle (4);
- a second set of four hydraulic actuators (14), each secured vertically to a respective arm (4a) of the cradle and extendible thus to an operative position in which a tapered bolt (16) afforded by the free end of the relative rod (20) locates in a matching second socket (18) associated with the respective flat car body (6c, 6d); and,
- safety spring means (19), associated with each of the four hydraulic actuators of both sets (13, 14) at the end remote from the tapered bolt (16) and impinging in the axial direction on the relative rod (20) in such a way as to maintain the bolt (16) in the extended operative position.

4) An improvement as in claim 1, wherein the elevating means (7) are mounted to the pair of beams (6a, 6b) at points near to the barycentric vertical axis (X) of rotation, and consist in four mutually opposed pairs of cylinders (22, 23) of which first outer ends are anchored pivotably to separate points of a load bearing platform (24) rigidly associated with the beams (6a, 6b) in the transverse direction and with the kingbolt (10) at centre, and the remaining ends anchored jointly to one of four corresponding single feet (25) positioned to enter into contact with a datum surface (P) afforded by the railway track (3), such that in the at-rest limit position, the two mutually opposed cylinders (22, 23) of each pair are accommodated in coaxial alignment within a respective recess (26) created between a pair of horizontal and parallel brackets (27, 28) secured to and positioned outside the relative dimensional compass of the relative beam (6a, 6b) and forming a part of the platform (24), the platform being also one and the same as the means (60) by which the cradle structure (4) and the fixed structure (6) are interlocked.

5) An improvement as in claim 1, wherein the rolling elements (11) comprise at least two sets of four freely rotatable wheels, a first set (29) secured to the cradle structure (4), arranged two on each side of the vertical axis (X) of rotation and in such a manner as to roll in a corresponding pair of arcuate channels (31) afforded by the two beams (6a, 6b), and a second set (30) secured in a plane beneath the cradle (4) coin-

ciding substantially with the pair of beams (6a, 6b), arranged two at each end of the fixed structure (6) and freely engaging a second pair of arcuate channels (32) afforded by the underside of the cradle (4).

6) An improvement as in claim 1, wherein stabilizing means (21) consist in hydraulic actuators (33) positioned in pairs at opposite ends of the rigid cradle structure (4), each with one end secured to the cradle by screw means (34), and the remaining end fitted with a freely revolving wheel (35) set to roll on a line tangential to the barycentric axis (X) of rotation and capable of movement thus between a raised and non-operative limit position, assumed in the inboard configuration of the cradle, in which the wheel (35) is disposed within the vertical compass of the cradle structure (4), and an operative lowered position of contact with the datum surface (P), assumed when the cradle (4) is rotated from the inboard configuration to the outboard or roll-on/roll-off position.

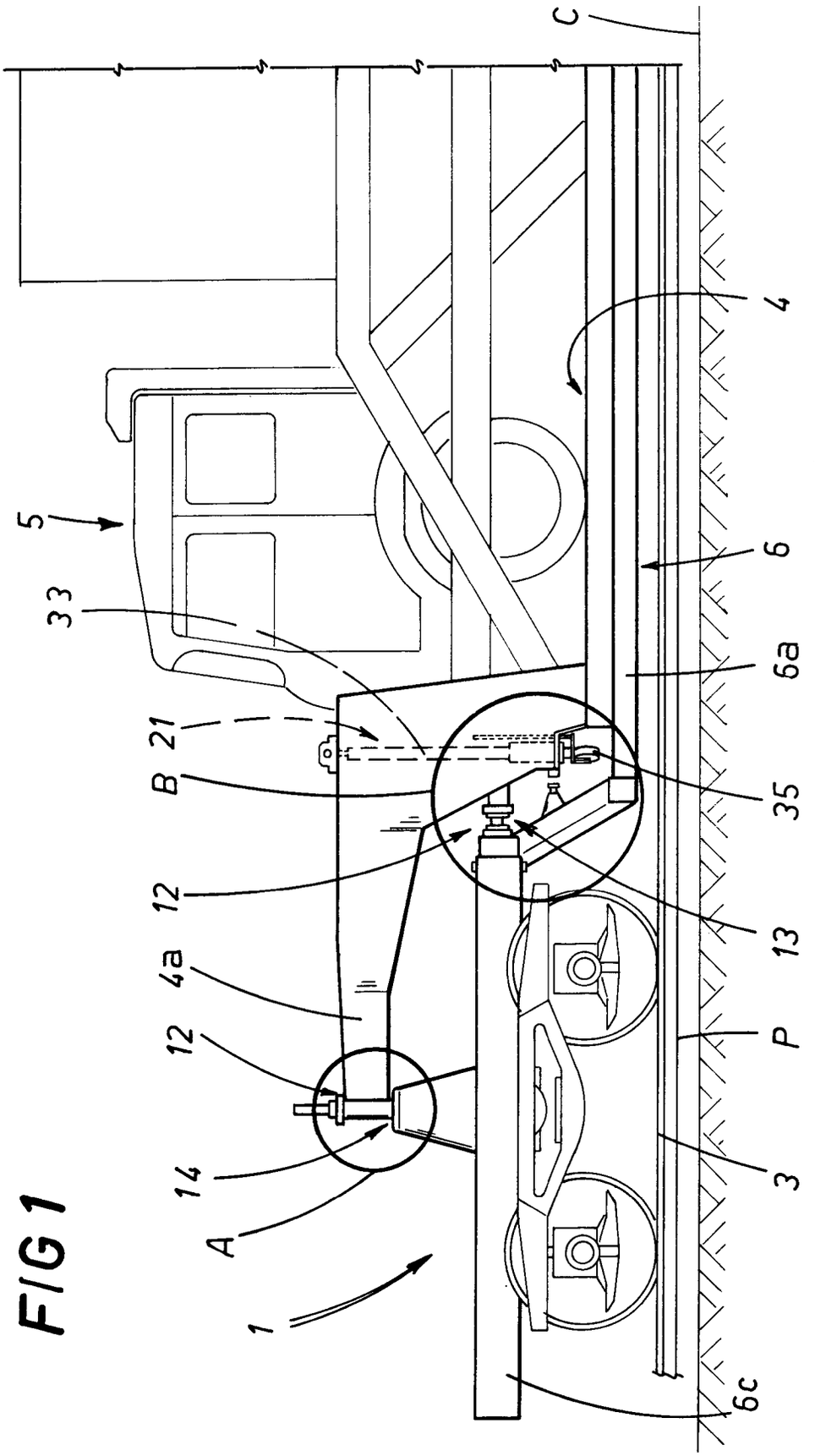


FIG 1

FIG3

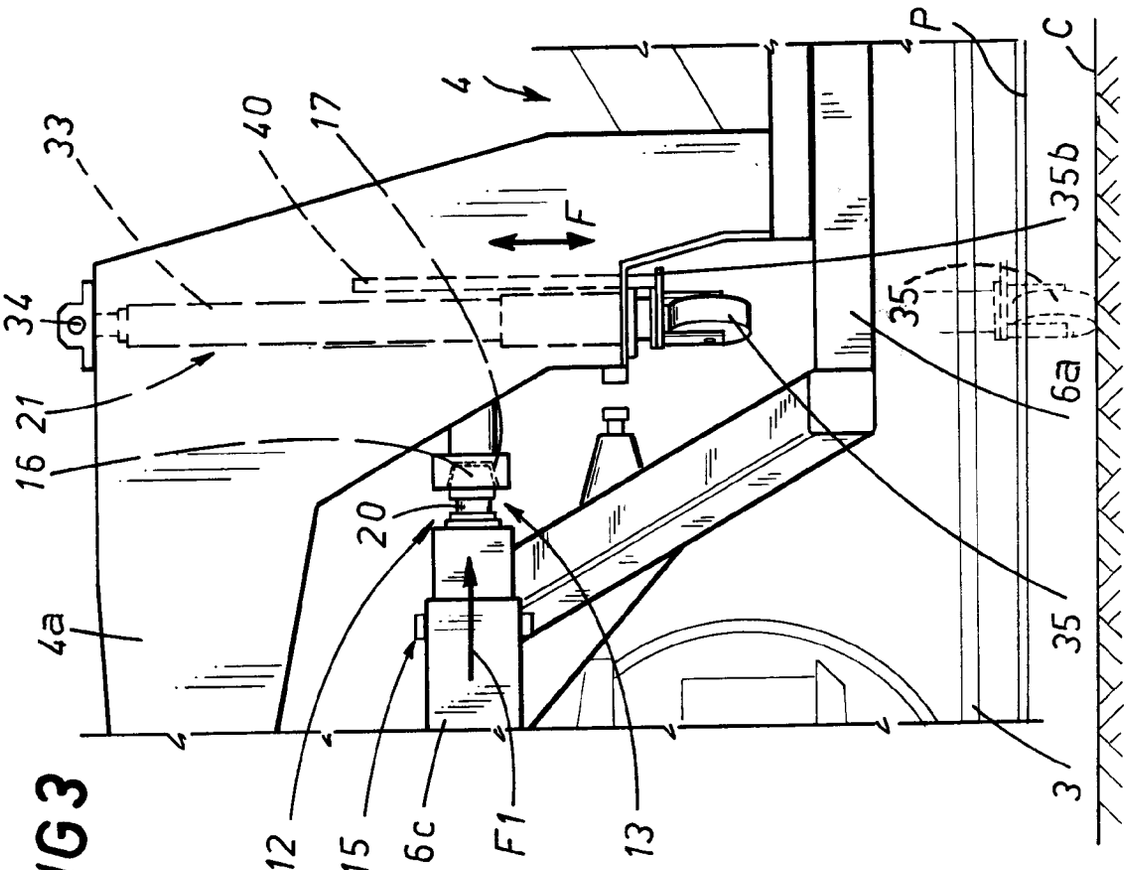
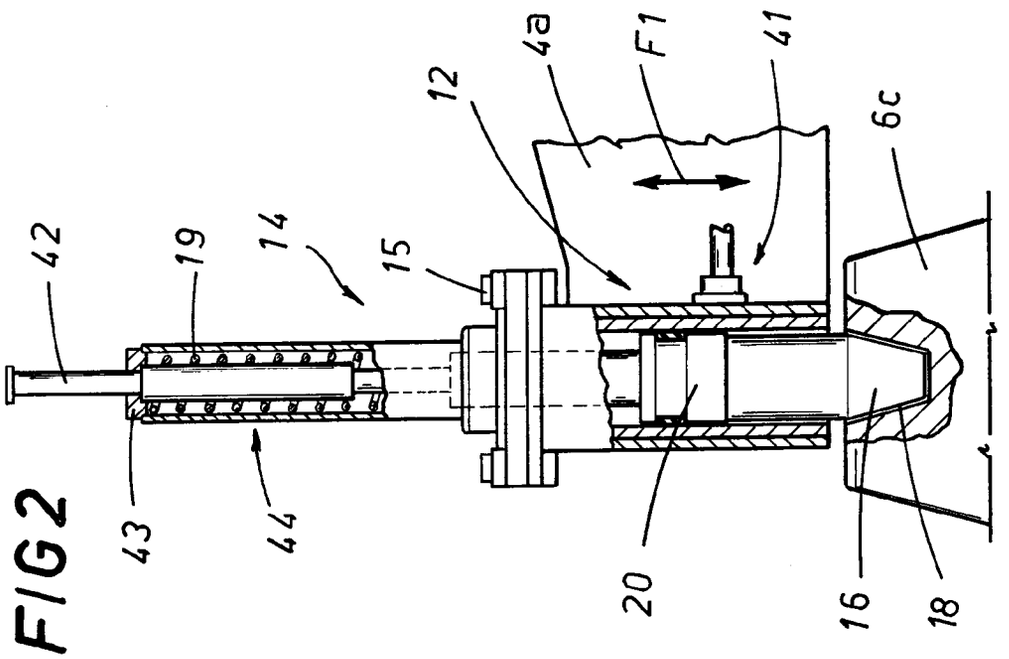

33
40
17
4
P
C
F
35b
34
35
16
21
6a
20
4a
35
3
12
15
6c
F1
13

FIG2


4a
F1
41
12
6c
42
19
14
15
43
44
20
16
18

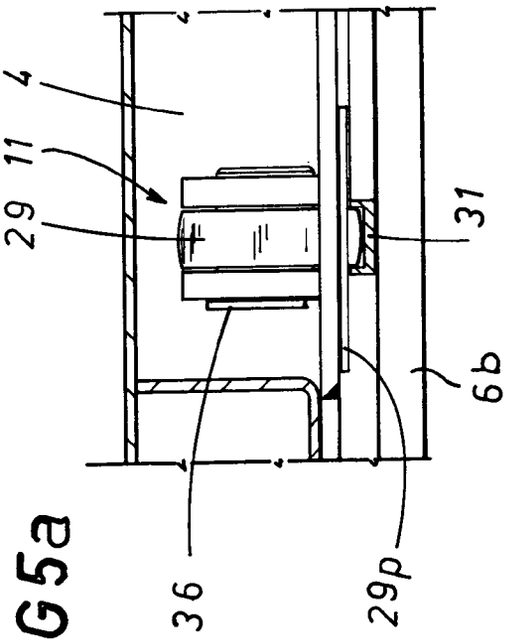


FIG5a

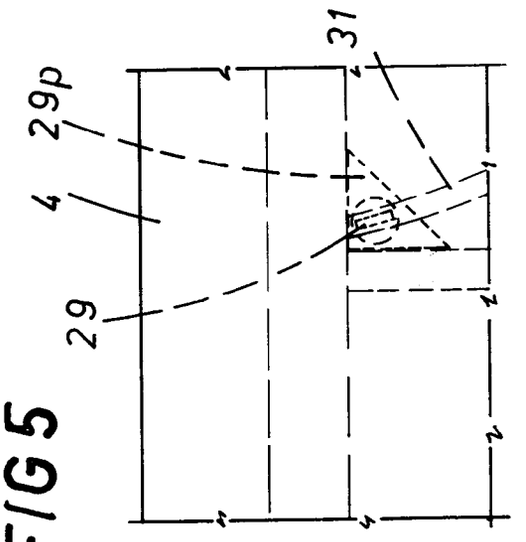


FIG5

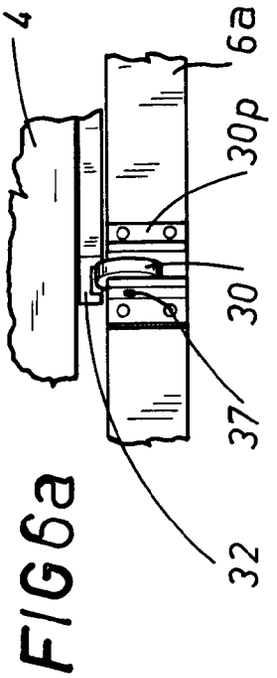


FIG6a

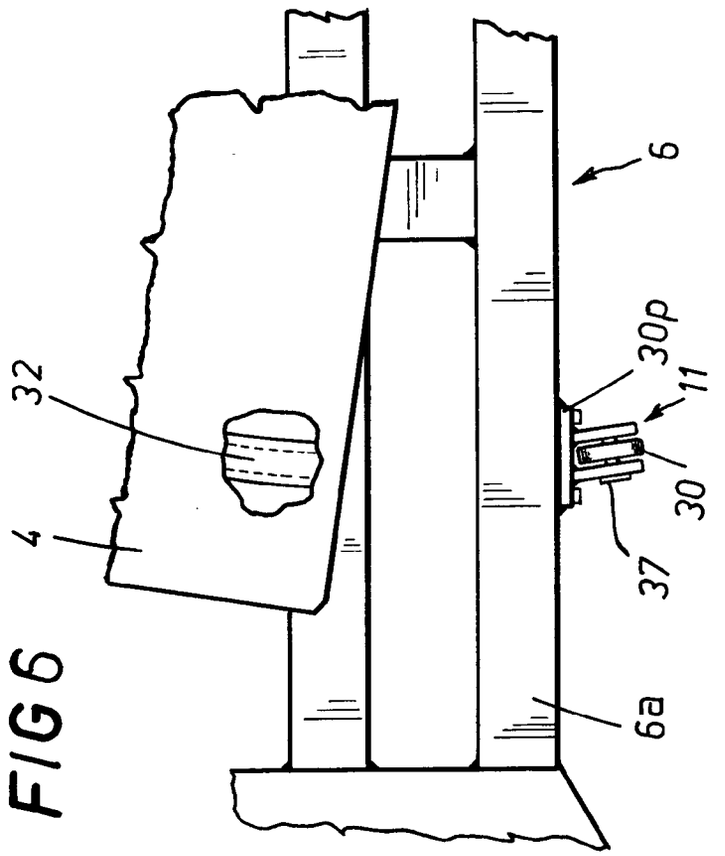


FIG6

FIG 7

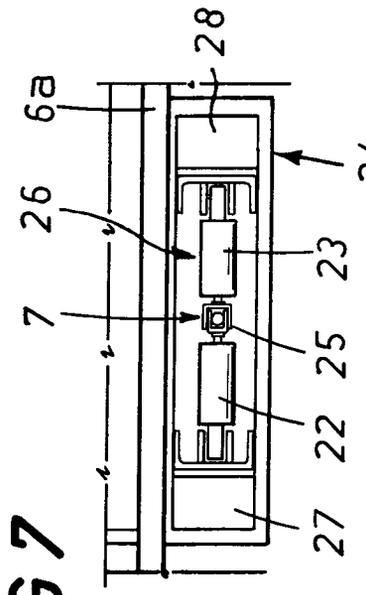

6a
28
24
26
23
7
25
22
27

FIG 4

1
6d
6b
6a
11b
30
6
D
11a
RV
10s
10c
10
X
10b
9
29
60
24
G
31
4
32
E
6c

FIG11

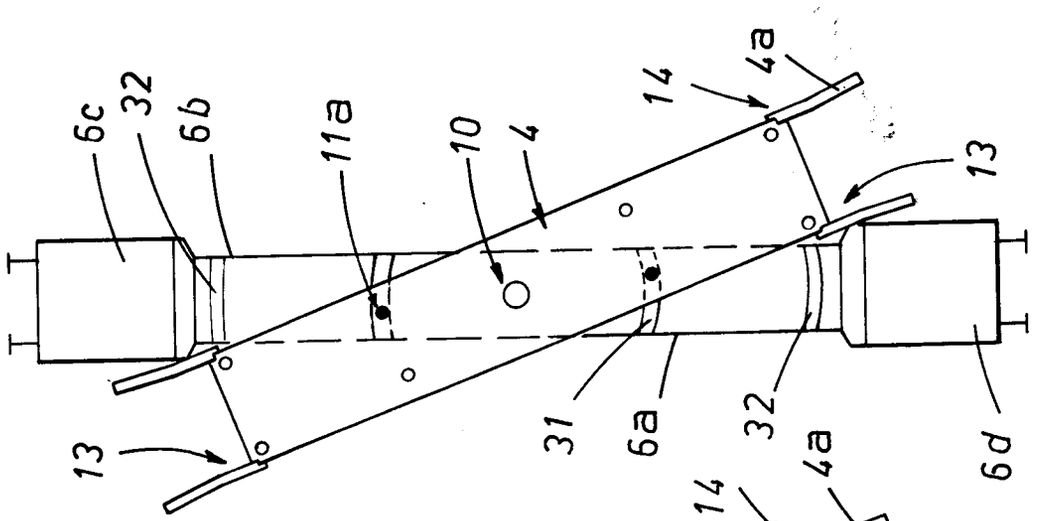


FIG10

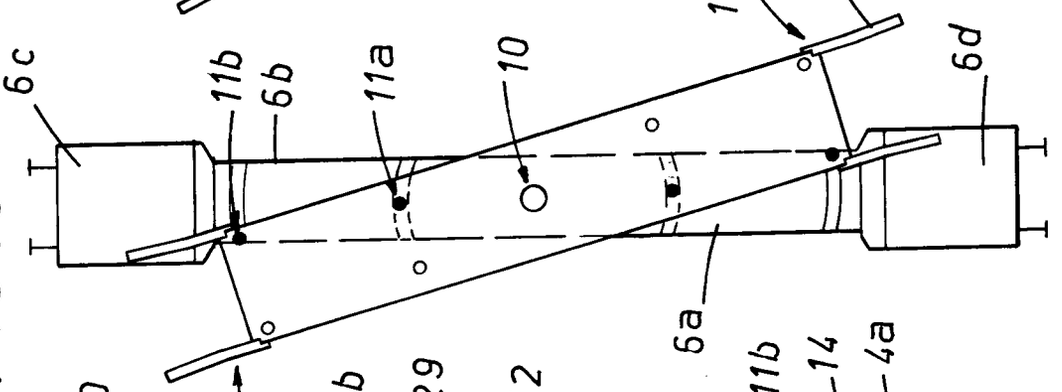


FIG9

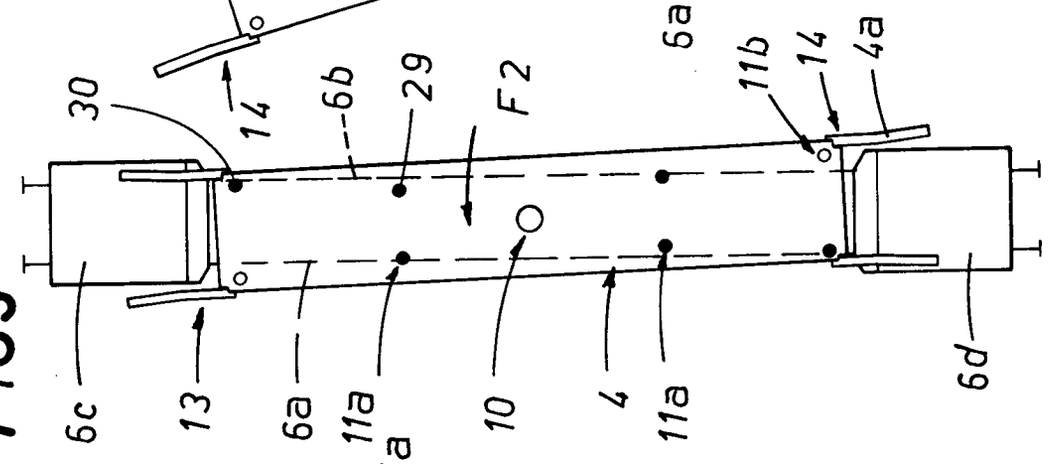
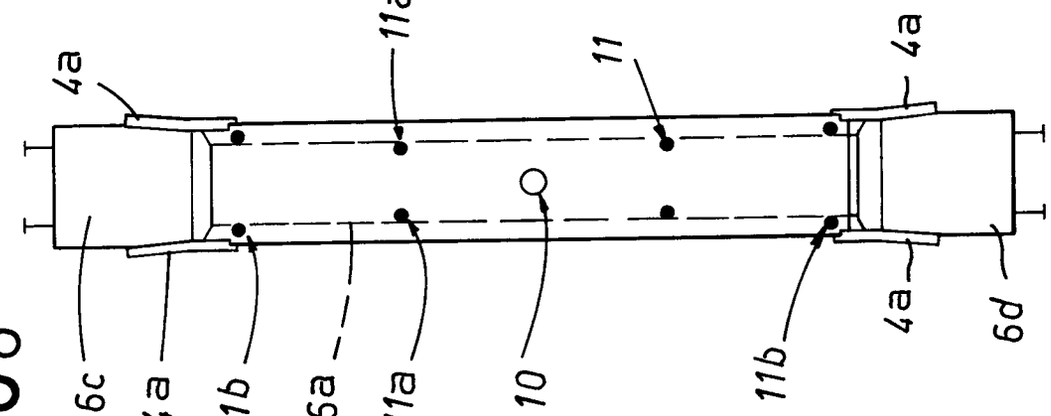


FIG8



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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0185

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)
D,Y	EP-A-0 463 283 (A.B.E.CO S.R.L.) * page 3, column 4, line 12 - line 51 * * page 4, column 5, line 14 - column 6, line 8 * * page 5, column 7, line 11 - line 36 * * page 5, column 8, line 3 - line 40 * * page 6, column 9, line 14 - line 40 * * page 6, column 10, line 1 - line 47 * * figures 1-3,5,6,8,10,10b *	1,2	B61D3/18 B61D47/00
D,A	---	3,4	
Y	EP-A-0 516 583 (TUCHSCHMID AG) * page 4, column 3, line 40 - column 4, line 8 * * page 4, column 4, line 47 - page 5, column 5, line 55 * * figures 1-6 *	1,2	
A	---	5	
A	DE-A-32 34 374 (WAGGONFABRIK TALBOT) * page 6, line 31 - page 8, line 14; figures *	1,5,6	TECHNICAL FIELDS SEARCHED (Int.Cl.5)
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A	WO-A-81 02142 (BEHRENS, RUDOLF) * page 3, line 18 - page 4, line 36; figures 1-4 *	1,5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 August 1994	Kulozik, E

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