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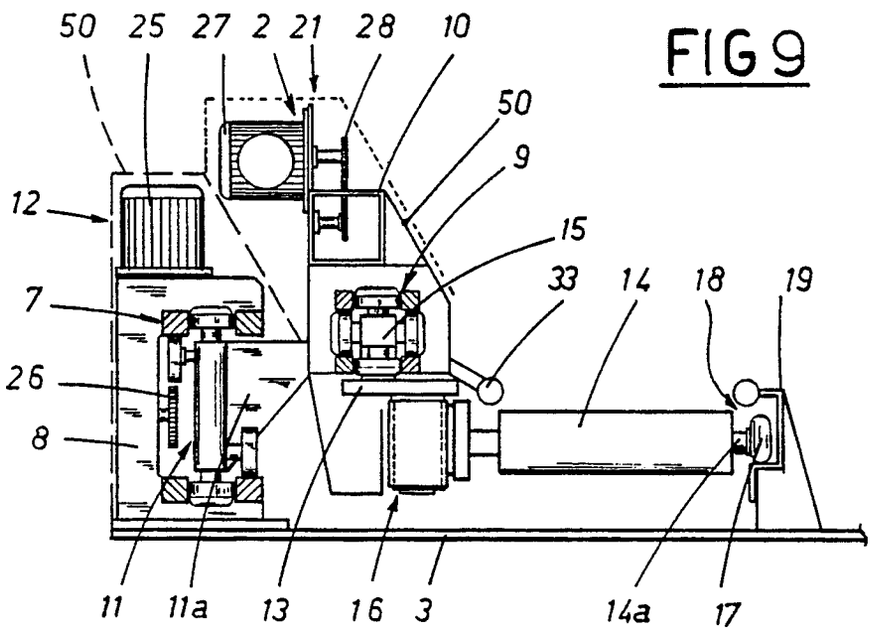
(54) Device for conveying automobiles on the same level, for use with lifts operating in multi-storey car parks.

(57) This device for conveying cars consists of a first moving guide (7) supported by a series of fixed brackets (8) adjacent and parallel to one of the longer sides of a lift (3), and a second moving guide (9) braced by a twist-resistant tube, the same length as the first moving guide (7) and running on it by means of a first carriage (11) moving along the second moving guide (9). A second carriage (15) runs along the second moving guide (9), supporting a plate (13) with a pair of idler rollers (14) with horizontal axes pivoting on it. The second guide (9) with the carriage (15) running inside it, has first and second chain drive means (12 and 21), enabling the second guide (9) to appear alternately on each of the shorter sides of the lift (3), and enabling the plate (13) to move freely; the rollers (14) are controlled by means (20) causing them to move between the hold and release position on a wheel (2a) of the car (2).

FIG 9



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This invention describes a device for conveying automobiles on the same level, for use with lifts operating in multi-storey car-parks or in car-washes.

This device may also be used to good advantage in mechanised single-storey car-parks where cars are conveyed by chain means, in which case the device will either be positioned at car entry or exit position of the chain drive means. No further reference will be made to this particular use since it will be covered by the general description.

The advantages to be had from automated car-parks, particularly multi-storey ones, as opposed to conventional parking-lots with driver parking have been known for some time, particularly in terms of large reductions in space occupied by cars and reduced construction costs.

Most multi-storey car-parks are rectangular-shaped and parking-lots are usually constructed in reinforced concrete floors, laid out side-by side and one above the other like two shelves facing each other across a central area where a conveyor-elevator is in operation moving the cars in or out as they are left or picked up. The conveyor-elevator is usually horizontally mobile on appropriate rails and equipped with a lift to support the car that can be moved up and down.

In another kind of car-park, that is circular in design, movement takes place by means of a turntable-elevator, consisting of a body or tower, extending vertically to the ground, rotating around its own axis and centrally fitted with the afore-mentioned lift; the turntable-elevator is thus able to position cars radially around floors in a radial lay-out, preferably in reinforced concrete.

Various techniques are used to convey cars either from the car-park entrance to the elevator-lift, or from the lift to the parking-place, and vice versa.

One of these techniques is a system whereby cars are conveyed either on pallets or platforms. The driver drives the car onto one of these pallets located at the car-park entrance, s/he switches off the engine, leaving the car with the brake on and doors closed, the pallet, with the car still on it, is then pulled onto the lift and taken to an appropriate parking-place. This system of moving pallets is used in automated warehouses and pallet size may be standardized or varied according to any car size whatsoever. The automated mechanism used is basically the same as that used in mechanised warehouses. However, a lot of time is wasted in manoeuvring, since the empty pallets also have to be moved around and construction costs are high as one pallet is needed per car.

In another widely used system the driver leaves the car at the car-park entrance in neutral gear with the brakes off, and the vehicle is moved on its own wheels by a carriage, this carriage having independent drive and moving from the lift to the car and the parking-places, being equipped either with retractable idler rollers or with a lifting mechanism acting on a pair of wheels. This carriage extends outwards from the lift and travels under the car parked at the car-park entrance, and is positioned, by means of appropriate sensors, and hooks onto the car and conveys the car onto the lift. Subsequently with the same backward or forward movement, the car is released at the parking-place. Conveyor carriage height has to be greater than the distance between the bottom of the car and the floor the car wheels are touching, so the carriage must be embedded beneath the running surface both on the elevator-platform and on all the parking lots, consequently the height of the various storeys of the car-park must be greater, resulting in increased overall car-park size and consequently increased costs. Complicated drive and conveying mechanisms prevent the carriage from being shielded by any protective covering, so it cannot be used in the open air. Furthermore the large overall dimensions of the carriage itself prevent the lift-surface from being used for car-park ventilation, as is easily done in car-parks with open air entrances and exits at ground level.

It is, therefore, the purpose of this invention to overcome the afore-mentioned disadvantages and to reduce construction costs by constructing a device for conveying cars on the same level, that will occupy minimum overall dimensions and height, will be situated completely outside the car, and will have protective covering for the device, consequently enabling it be used in the open air and eliminating the need for it to be constructed above the ground.

In the form of the claims characterising it, this invention resolves the afore-mentioned disadvantages with a device for conveying cars, consisting of a first moving guide supported by a series of fixed brackets, adjacent and parallel to one of the long sides of a lift, and a second moving guide, the same length as the first one, connected to a tube and running on the first moving guide by means of a first carriage moving along the second moving guide. A second carriage runs along the second moving guide, supporting a plate with a pair of idler rollers with horizontal axes pivoting on it. First and second chain drive means, move the first and second carriage, causing the second guide to travel outwards on each of the short sides of the lift, also enabling the plate to move freely; the rollers are controlled by means causing them to alternate between the hold and the release position on one wheel of the car. The following are the main advantages of this invention:

- this system for aligning and conveying cars may be used with all cars, regardless of tread and

wheelbase, without any complicated sensors or drive mechanisms, consequently simplifying construction, reducing costs and increasing operating safety;
- neither minimum floor height nor parking-place width will have to be increased;
- the very small dimensions of the device mean that most of the elevator-platform grid serves as natural ventilation to the car-park, allowing car-silos to be designed without any above ground projections, or ramps to be designed of a minimum length that would not allow for the construction of more than one car-park side-by-side;
- the car can enter on the short side of the lift and leave on the opposite side, very little manoeuvring time is involved since part of the dead time in moving the conveyor-elevator unit is taken up with part of the horizontal manoeuvres;

This invention is subsequently explained in greater detail in the following description with the diagrams enclosed, these being only one example of the invention and not to be interpreted as being in any way restrictive.

- Fig. 1 is a diagram showing an overall schematic view from above, of a lift inside a cylindrical-shaped underground multi-storey car-park equipped with the device in the terms of this invention;

- Fig. 2 is a diagram showing an overall view from above, of the device in the terms of this invention;

- Figures 3, 4, 5, 6 and 7 are diagrams showing side views of the device in Fig. 2 in five different operating positions;

- Fig. 8 is a diagram showing a perspective view, with some parts removed to show others, of an enlarged view of part "A" in Fig. 2;

- Fig. 9 shows a cross section of the IX-IX trace in Fig. 2;

- Fig. 10 shows an enlarged view of part "B" in Fig. 1.

- Fig. 11 is a diagram showing an overall view from above of a constructional variation of the conveying means of the device shown in the previous figures.

- Fig. 12 is a diagram showing a front view with some parts removed of the constructional variation in Fig. 11.

- Figures 13a, 13b and 13c are diagrams showing overall views from above of a car being picked up from a platform.

- Figures 14a and 14b are diagrams showing overall views from above of a car being parked in the same direction that it is being picked up from in Figures 13.

- Figures 15a, 15b and 15c are diagrams showing overall views from above of a car being parked on the opposite side of the one that it is being picked up from in Figures 13.

With reference to the enclosed figures, it can be seen that this conveying device is to be used in an underground multi-storey car-park with access to the open air at entry level (its total surface area being marked as 100 in Fig. 1) and which, in the case described here, is cylindrically-shaped.

The centre of this car-park, 100, has a vertical seat containing a moving and conveying device, in the case described here a turntable-elevator, 1, complete with lift, 3, which is only shown at entry level. Inside this car-park, 100, there are a number of parking-places, 4, for cars, 2, occupying several floors (since this system is known it is not shown in full).

There is a small entry lane, 22, to the car-park, 100, where the car, 2, is positioned for conveying operations onto the lift, 3. This lane, 22, has a pair of guides, 23, and the wheels of one side of the car, 2, to be parked, pass between these guides, usually the left side of the vehicle because it is easier for the driver to align the car at the entry point; furthermore, the front left wheel, having already been mentioned as the side chosen for alignment, is positioned on a small wedge, 24, constructed inside the floor of the entry lane, 22: in this way only one wheel of the car, 2, has been accurately positioned as regards the lift, 3, thus enabling this invention to work perfectly, regardless of the wheelbase or tread of the vehicle.

The lift, 3, is equipped with means, 5, shown in their total surface area in Fig. 1, for conveying the car, 2, on the same level, either from the small entry lane, 22, (or from the parking-place, 4) to the lift or vice versa. These means, 5, consist of a first moving guide, 7, extending for the entire length of the lift, 3 and supported by a series of staffs, 8, fixed to the surface of the lift, 3. This first guide, 7, is parallel to the long side of the lift, 3, being located on one side of the lift (on the left side in Fig. 1) so as to be outside the area defined by the wheels and the outline of the car, 2. This first moving guide, 7, is C-shaped in cross-section, with the open side facing the inside of the lift, 3.

Parallel to the first guide, 7, there is a second moving guide (or arm), 9, of approximately the same length as the first one, this too is C-shaped and has the open side facing the platform forming the surface of the lift, 3.

This second guide, 9, has a twist-resistant tube, 10, connected to and running alongside it. This arm, 9, faces towards the inside of the lift, 3, and is connected to the first guide, 7, by means of a first carriage, 11, (see Figures 3 and 9) which has two supports, 11a, running inside the the first moving guide. In order for the first carriage, 11, to be able to run inside the first guide, 7, there are first chain drive means, 12, consisting of a first reducer-

motor, 25, fixed to the top of the first guide, 7, moving a first continuous-link chain, 26, connected at its ends to carriages, 11. A second carriage, 15, (which also has two end supports, 15a) runs inside the arm, 9, supporting a plate, 13, outside the arm, 9. This plate, 13, supports a pair of idler rollers, 14, with horizontal axes freely pivoting around a corresponding pin, 14a, pivoting on the afore-mentioned plate, 13. In order for the second carriage, 15, to be able to run inside the arm, 9, there are also second chain drive means, 21, consisting of a second reducer-motor, 27, fixed to the side of the profiling, 10, moving a second continuous-link chain, 28, connected at its ends to the second carriage, 15.

Conveying means, 20, acting on said pins, 14a, consist of a hydraulic cylinder, 20, moving two vertical pins, 16, connected to corresponding pins, 14a. This cylinder, 20, therefore, has the task of moving the pins, 14a, (and consequently the rollers, 14) between the two extreme stable positions: namely the open position of release, whereby the rollers, 14, are co-axial to the arm, 9; and the second closed operating position, whereby the rollers, 14, are at right-angles to the arm (see arrows F in Fig. 8).

In the extreme operating position the pins, 14a, come into contact with a profiling, 19, parallel to and facing the arm, 9; the top of this profiling has a recess, 18, housing a small wheel, 17, fitted to the free end of each of the pins, 14a. There is also a recess, 18, on the inside guide, 23, of the small entry lane, 22, as well as on the guide in the exit position.

Figures 11 and 12 show a constructional variant of the first and second chain means, 12 and 21, whereby the first chain means, 12, consists of a first chain, 80, connected at the side by means of horizontal plates, to the first carriage, 11, and continuously linked to a pair of first toothed wheels, 81a and 81b, keyed to the respective ends of a pair of first rods, 82a and 82b, coaxial and opposite each other. The rods, 82a and 82b, are both fixed at their free ends to a single first piston, 83, located inside a hydraulic cylinder, 84, acting as a dividing wall between said rods and therefore forming two separate chambers in the cylinder, 84, so as to determine, by the controlled passage of fluid from one chamber to the other, or vice versa (thanks to a well-known kind of pump, either controlled by the operator or by the central system not shown here) the alternate, simultaneous movement, in either direction, of the pair of rods, 82a and 82b, and of the first carriage, 11.

Similarly the second chain means, 21, consists of a second chain, 85, connected at the top to the second carriage, 15, and continuously linked to a pair of second toothed wheels, 86a and 86b, keyed to the respective ends of a pair of second rods, 87a and 87b, coaxial and opposite each other. The second rods, 87a and 87b, are both fixed at their free ends to a single second piston, 88, located inside a second hydraulic cylinder, 89, acting as a dividing wall between said rods and therefore forming two separate chambers in the second cylinder, 89, so as to determine the passage of fluid from one chamber to the other, or vice versa, (also controlled by a second pump which is not shown here) the alternate, simultaneous movement in either direction, of the pair of rods, 87a and 87b, and of the second carriage, 15.

The device that has just been described and shown in Figures 3, 4, 5, 6 and 7 works as follows: the car, 2, to be parked is left on the small entry lane, 22, to the car-park, 100 with the engine switched off and in neutral gear. The lift, 3, is either already aligned (or aligns) with the small entry lane, 22, so the first reducer-motor, 25, is activated which, by means of the first chain, 26, causes the arm, 9, to travel out from the short side of the lift, 3, to the full extent of its total travel limited by the stop of one of the two supports, 11a, of the carriage, 11, against the end of the first guide, 7, (see Fig. 3), taking the second carriage, 15, (already previously positioned at the end of the arm, 9, by means of the reducer-motor unit, 27, the second chain, 28, and with the rollers, 14, in the open release position) axial to the front left wheel, 2a, of the car. At this point the hydraulic cylinder, 20, is activated, turning the rollers, 14, to the extreme operating position, i.e. in front of and behind the wheel, 2a, in such a way as to come into contact with it (see position shown in Fig. 3).

The first reducer-motor, 25, is then activated in the opposite direction, taking the arm, 9, inside the lift, 5, and at the same time the second reducer-motor, 27, is activated, pulling the second carriage, 15, towards the opposite side of the lift, 3, thus pulling the entire car, 2, onto the lift (see Figures 4 and 5), and stopping in the stable position once the rear left wheel, 2b, has engaged in the appropriate little wedge, 24m. The profiling, 19, and a series of tubular rollers, 33, connected to the second guide or arm, 9, extending along its entire length, act as guides, enabling the car, 2, to move forward in a perfectly straight line, furthermore, thanks to the small wheels, 17, resting on the profiling, 19, the arm, 9, is not subject to most of the torsion or stress. At this point the lift, 3, will convey the car, 2, to the position opposite the parking-place, 4, by means of vertical transfer and rotation of the lift-support tower.

The operations that have just been described are then repeated in the opposite direction so that the vehicle can be parked in one of the parking-places inside the cylindrical car-silo.

For the car, 2, to be released from the lift, 3, of the car-park, 100, in a forward direction, car pick-up operations are performed in the same way, but while the lift, 3, is being moved, the rollers, 14, (which are in the closed position on the front wheels) are opened, the chain, 28, conveys the plate, 13, from the front wheel, 2a, to the rear wheel, 2b, (see Fig. 6) and the rollers, 14, are turned to the operating position ready to move the car, 2, in a forward direction as soon as the turntable-elevator has stopped in the corresponding position; at the exit, the moving arm, 9, is pushed outside in the opposite direction (see arrow B in Fig. 1) to that of entry (as can clearly be seen in Fig. 7) still connected to the first guide, 7, by means of the first carriage, 11, and thanks to the thrust of the rollers, 14, on the rear wheel, 2b, the car, 2, completely leaves the lift, 3, the same wheel, 2b, coming to rest on a stopping wedge, 24b. No further manoeuvres are required so the car can be driven away. Obviously the exit point, shown in Figure 1, will not necessarily be opposite the entry point, but in whichever position the builders consider to be most convenient, in which case elevator rotation may also be made use of; figures 13, 14 and 15 and their respective letters show the various movements, in succession, that can be performed by this device: namely picking up the car (see figures 13a, 13b and 13c), parking the car on the same side as the one where it was left (see figures 14a and 14b) or parking the car on the opposite side from the one where it was left (see figures 15a, 15b and 15c). In rectangular car-silos this manoeuvre will also have to be done when parking cars in parking-places in lots opposite the entry position.

Another drive system could also be fitted directly onto the afore-mentioned rollers, 14, which could therefore rotates independently, adhering to the car-wheels both during the pushing and the pulling motion, and also acting as a brake for the wheel, thus reducing manoeuvring time even further.

The entire device, and particularly the guides, 7 and 9, may also be protected by means of one or more casings or covers, 50, so that the invention could be used in the open air, this also being on account of the car being positioned at the side and the reduced dimensions of the entire manoeuvring device. This would also free the lift platform for a raised surface which could also, if it were a grid, be used as a natural ventilation shaft for the car-park; thus enabling car-silos to be built which, when completed, consisted solely of a grid core, equal in diameter to the length of the car to be parked, and which would only be protected by circular or polygonal parapets with automatic openings.

Once the elevator-platform, connected to the rotation or conveyor support, shows the inevitable play needed for it to run freely along the vertical guides, and also considering that conveying cars from the lift-platform may cause still further play between the two, it is best to use the hydraulic unit to move the hydraulic cylinder, 20, and also to activate one or more small hydraulic pistons, 40, (one of these can be seen in Fig. 10) situated at the two ends of the lift-platform, 3. These small pistons, 40, have a conical head which enters a centring sleeve, 41, set into the reinforced concrete casting of the parking-places, 4. When the lift-platform reaches the parking-place that the car is to be conveyed to, the small pistons leave the platform and, as they enter the fixed sleeves, eliminate any play, giving perfect alignment and locking between the mobile platform and fixed structure.

This invention can be subjected to numerous modifications and variations, all of which are within the terms of this invention. Furthermore any or all of these details can be replaced by their technical equivalents.

Claims

1) Device for conveying cars on the same level used on lifts operating in multi-storey car-parks consisting of at least one device (1) for conveying and transferring cars (2), this device being able to move at an angle or traverse and equipped with a lift (3) which is vertically mobile from ground or entry level to the levels of the different floors of the parking-places (4) of the cars (2), and with means (5) for conveying the car (2) from said lift (3) to a parking-place (4) and vice versa, **wherein** said means (5) consist of the following:

- a first guide (7) extending along the entire length of the platform, limiting the surface of said lift (3) and fixed parallel to it lengthways and adjacent to one of its long sides;
- a second guide or arm (9) of approximately the same length as the first one, located parallel to it and facing towards the inside of said lift (3), this second guide (9) being connected to said first guide (7) by means of at least one first carriage (11) running on the first guide; first means (12) in the form of continuous-link drive chains, these being located on said first guide (7) and connected at their ends to said first carriage (11), conveying the carriage lengthways in either direction, so that said second guide (9) will travel outwards alternately on either of the short sides of said lift-platform (3) for sufficient length to bring them in the vicinity of one side of the car (2) at least at the front (2a) or rear wheel (2b) nearest to said lift (3).
- a plate (13) supporting a pair of idler rollers (14) with horizontal axes connected to said second

guide (9) by means of a second carriage (15) running inside the second guide, these rollers (14) being equipped with corresponding support pins (14a) pivoting coaxially on said plate (13); second means (21) in the form of continuous-link drive chains, these being located on said second guide (9) and connected at their ends to said second carriage (15), conveying the carriage lengthways in either direction for almost the entire length of said second guide (9), enabling said plate (13) to be brought in the vicinity of either the front (2a) or the rear wheel (2b) of the car (2); means (20) of conveying, acting, upon request, on said mobile support pins (14a) and having two extreme positions, one of rest, whereby the rollers (14) are in a sufficiently co-axial position to the second guide (9), enabling lengthways movement of said plate (13), and the other being an operating position, whereby the rollers (14) are almost at right-angles to said guides (7 and 9) and in a position where they will come into contact with said wheel (2a) of the car (2).

2) Device according to the description in claim 1, **wherein** said pins (14a) are each equipped, at their free end, with a small wheel (17) to be coupled, when said rollers (14) are in the extreme stable operating position, to a corresponding recess (18) on a profiling (19) fixed to the platform of said lift (3) and parallel to and facing said second guide (9) at a distance which may not be less than at least the maximum width of said wheel (2a).

3) Device according to the description in claim 1, **wherein** said first guide (7) is moving and supported by a number of brackets (8) fixed to the lift-platform (3), and C-shaped at the open side facing the inside of the lift (3).

4) Device according to the description in claim 1, **wherein** said second guide or arm (9) is moving and open on the side facing the platform of said lift (3), having a tube (10) resistant to torsional stress.

5) Device according to the description in claim 1, **wherein** said means (20) of moving said pins (14a) consist of a hydraulic cylinder (20) connected to a hydraulic control unit, with its ends connected to two vertical pins (16), fixed to said plate (13), and each supporting a corresponding pin (14a).

6) Device according to the description in claim 1, **wherein** said rollers (14) are equipped with their own direct drive unit allowing them to rotate around said pins (14a), independently of each other.

7) Device according to the description in claim 1, **wherein** said first and second guides (7 and 9) are externally protected by covers (50) at least one of which is fixed to said first guide (7) and at least the other of which is fixed to said arm (9) and moving with it.

8) Device according to the description in claim 1, **wherein** said arm (9) is equipped with a series of small tubular rollers (33) fixed parallel to the same arm (9) and forming an external guide to said wheel (2a) with the object of lessening any friction against this wheel while it is being moved.

9) Device according to the description in claim 1, **wherein** said first chain means (12) consists of a first chain (80) connected at the side to said first carriage (11) and continuously linked to a pair of first toothed wheels (81a and 81b) keyed to the respective ends of a first pair of rods (82a and 82b) coaxial and opposite each other; said rods (82a and 82b) both being fixed at their free ends to a single first piston (83) located inside a hydraulic cylinder (84) acting as a dividing wall between said rods and therefore forming two separate chambers in said cylinder (84), so as to determine, by the controlled passage of fluid from one chamber to the other, or vice versa, the alternate, simultaneous movement, in either direction, of the pair of rods (82a and 82b) and of said first carriage (11).

10) Device according to the description in claim 1, **wherein** second chain means (21) consists of a second chain (85) connected at the top to said second carriage (15) and continuously linked to a pair of second toothed wheels (86a and 86b) keyed to the respective ends of a second pair of rods (87a and 87b) coaxial and opposite each other; said second rods (87a and 87b) both being fixed at their free ends to a single second piston (88) located inside a second hydraulic cylinder (89) acting as a dividing wall between said rods and therefore forming two separate chambers in the second cylinder (89) so as to determine, by the controlled passage of fluid from one chamber to the other, or vice versa, the alternate, simultaneous movement in either direction, of the pair of rods (87a and 87b) and of said second carriage (15).

FIG1

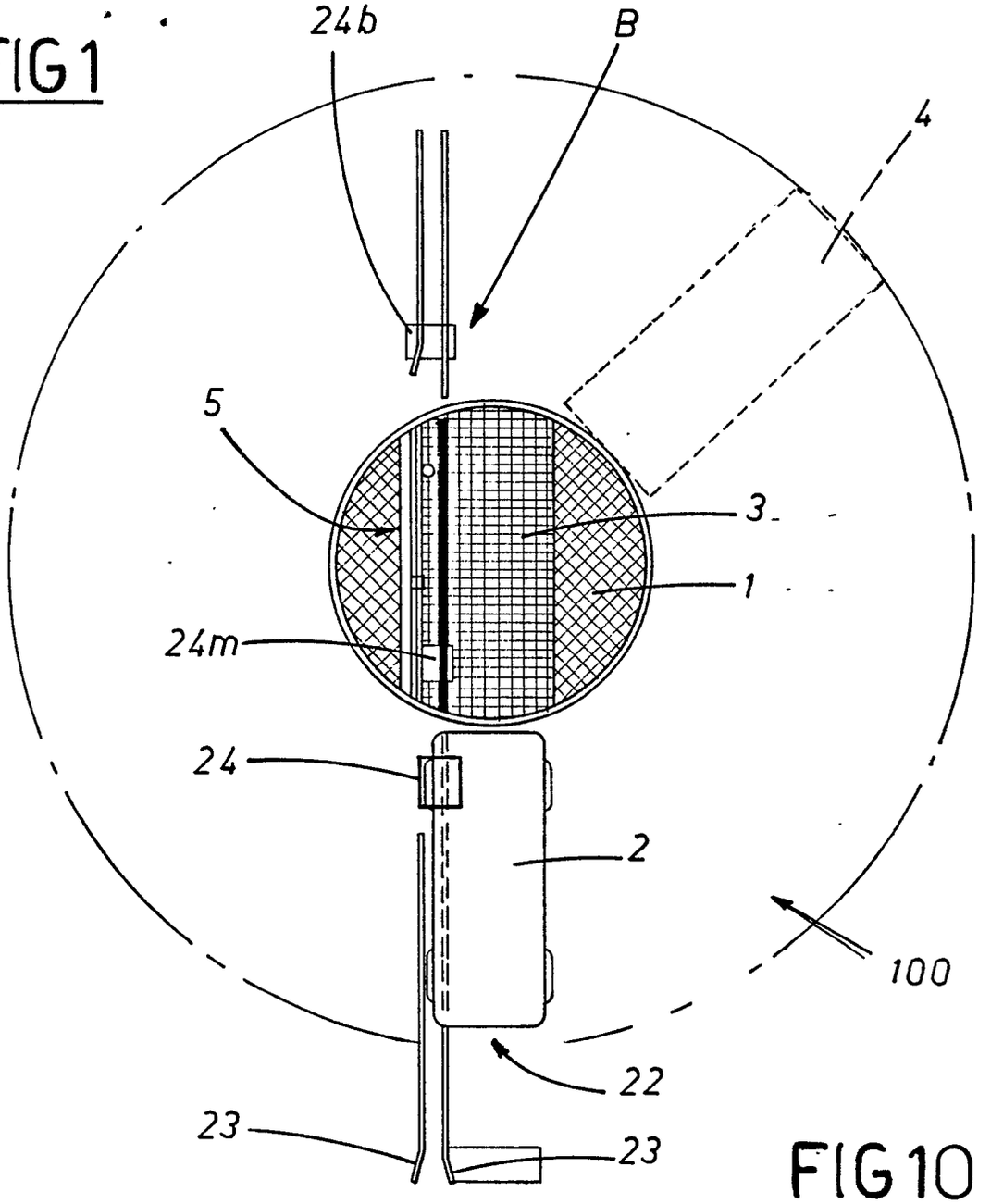
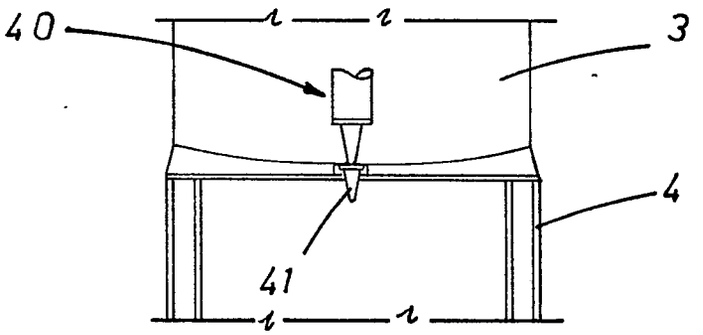


FIG10



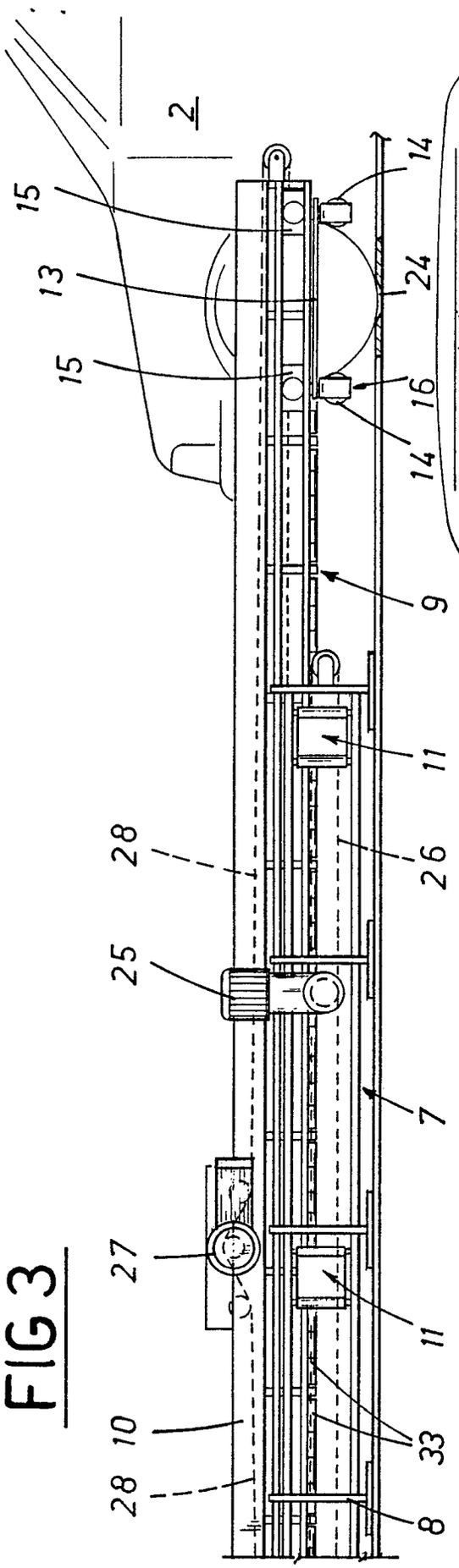

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FIG 3

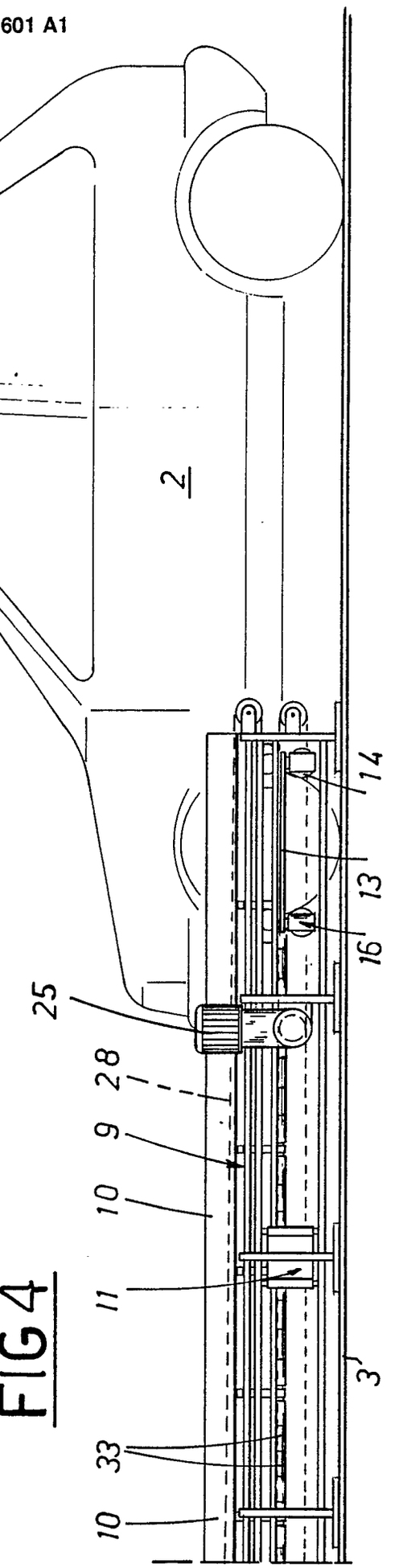
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FIG 4

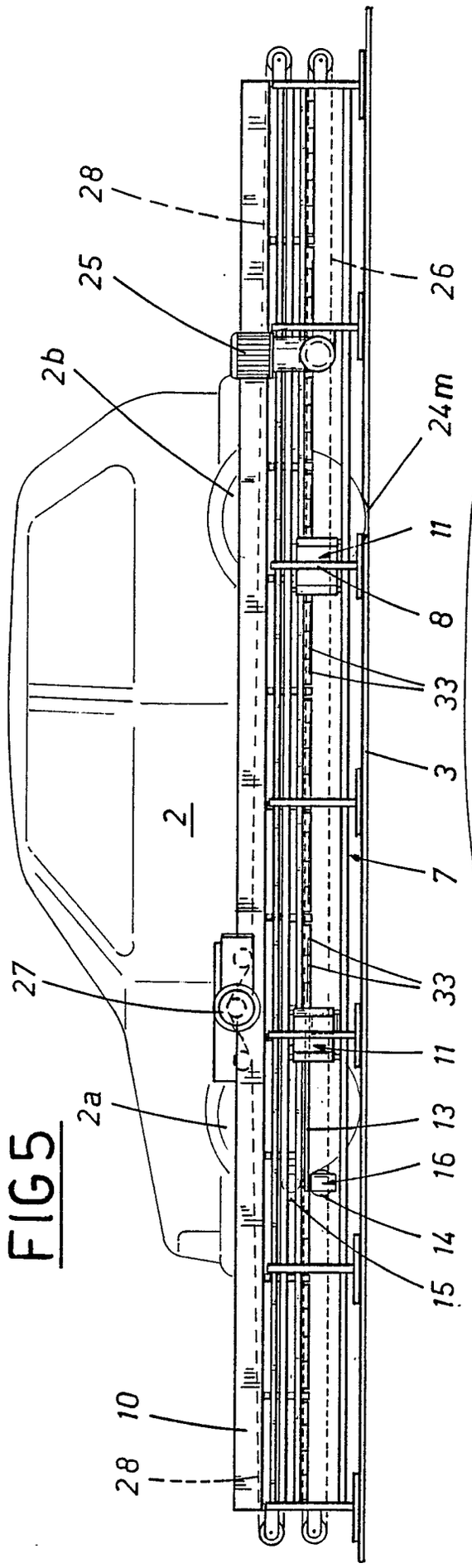
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FIG5

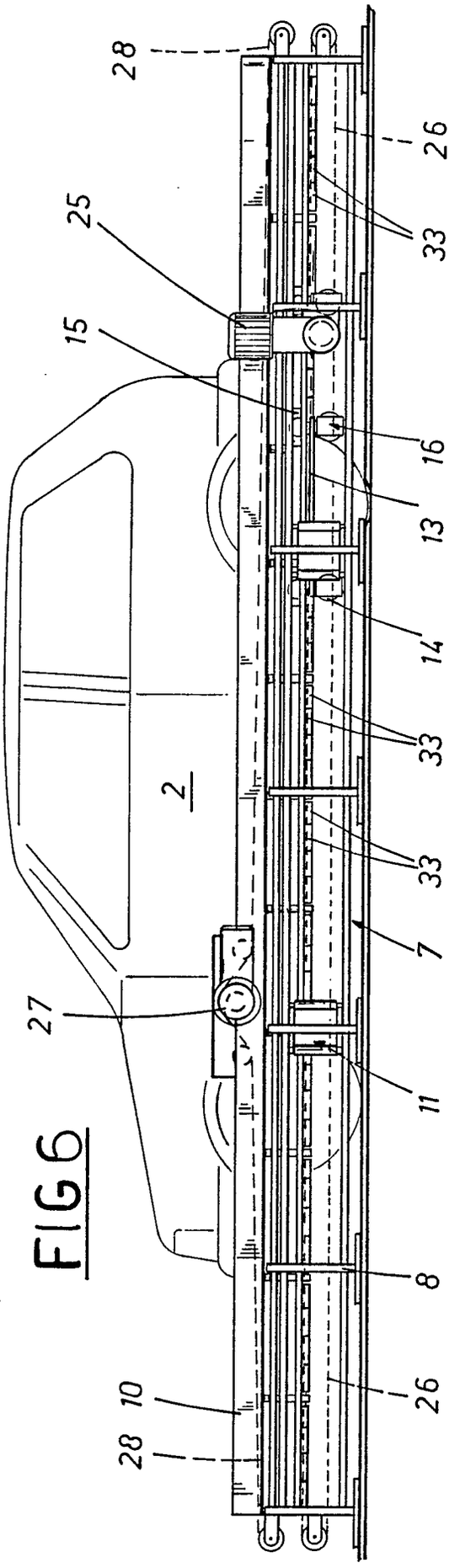
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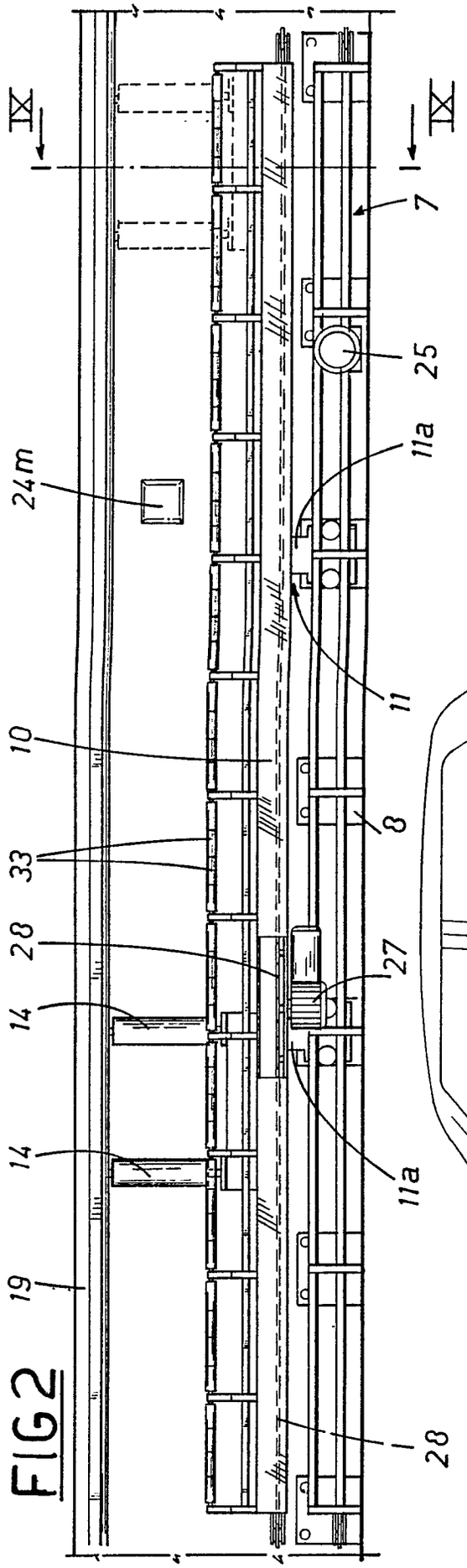
FIG6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28

FIG2

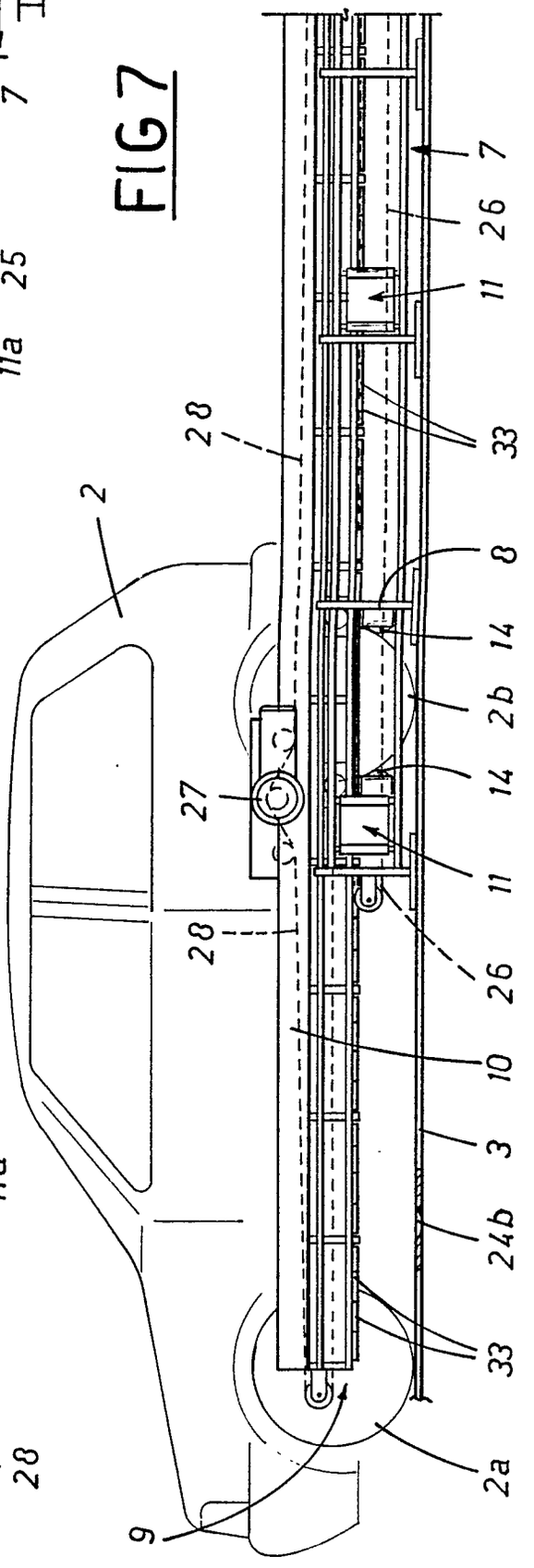

7
26
11
28
33
2
8
14
2b
27
14
11
28
26
10
3
24b
33
2a
9

FIG7

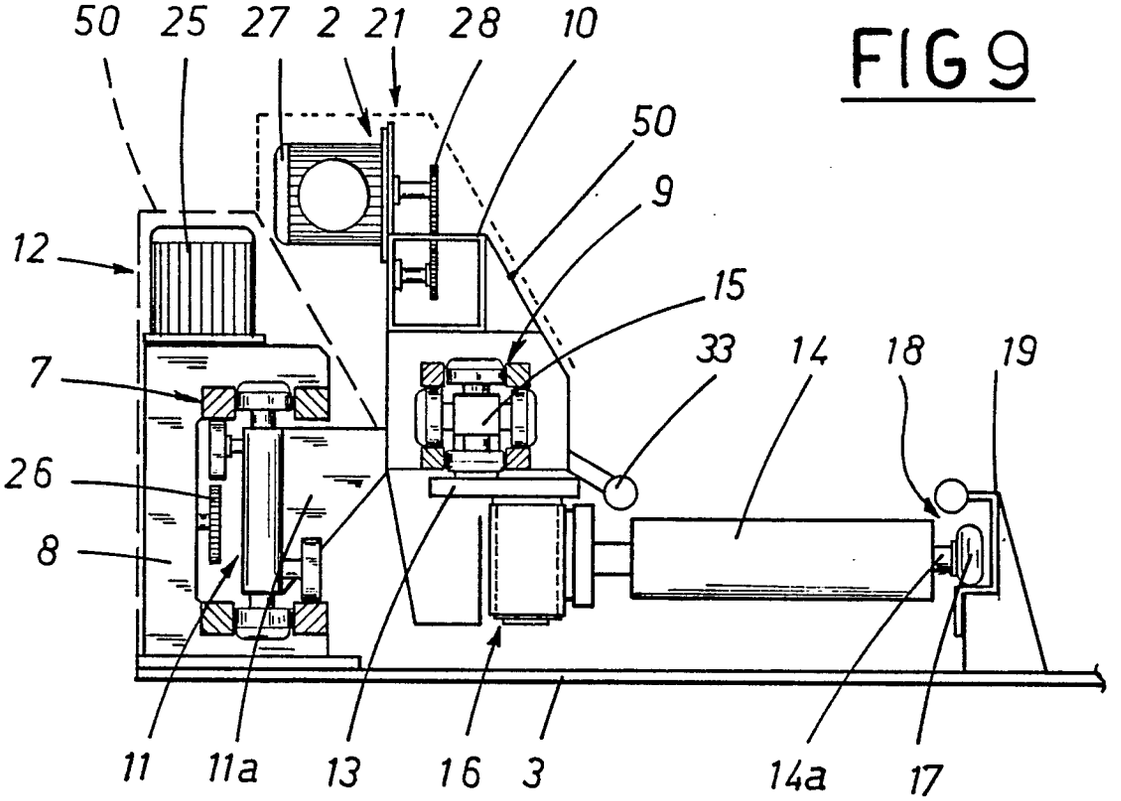

50
25
27
2
21
28
10
50
9
12
15
33
14
18
19
7
26
8
11
11a
13
16
3
14a
17

FIG 9

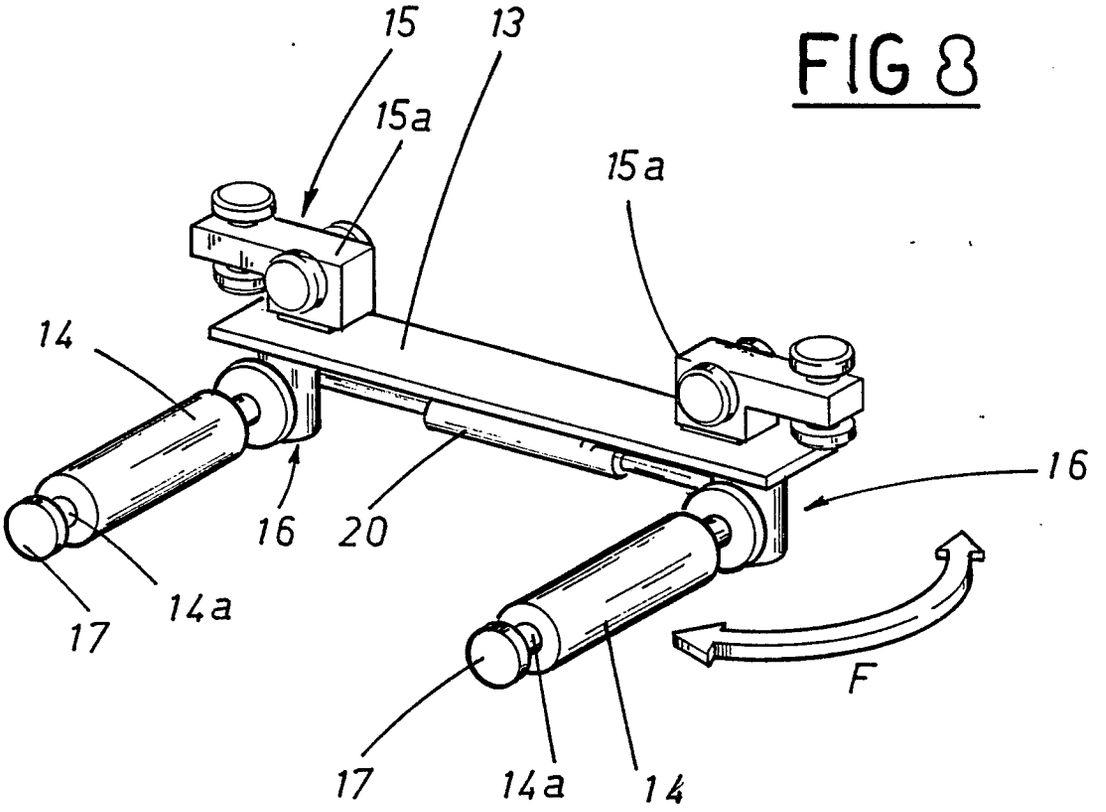

15
13
15a
15a
14
16
16
20
17
14a
F
17
14a
14

FIG 8

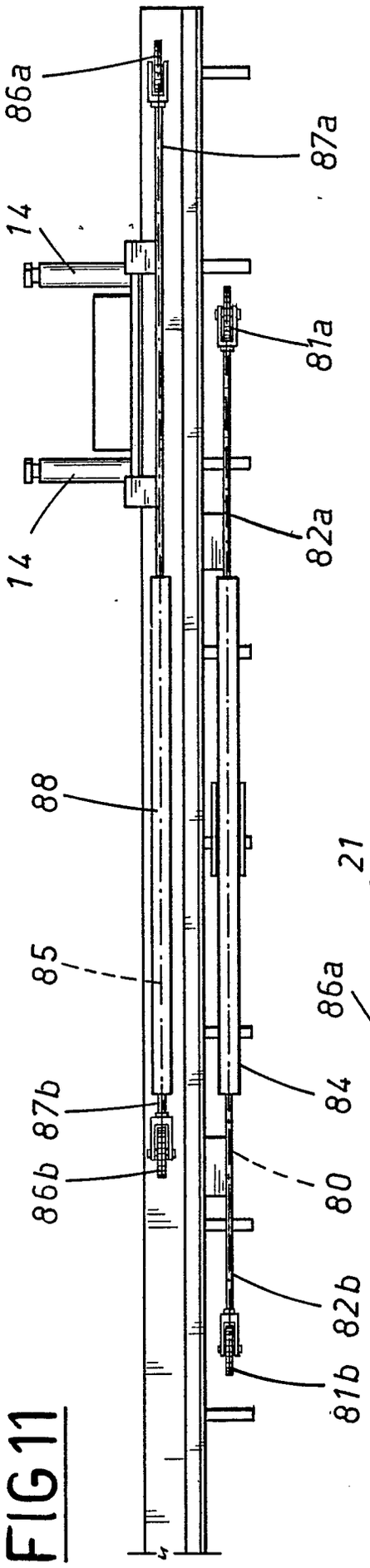

86a
87a
14
81a
14
82a
88
85
87b
84
86b
80
82b
81b

FIG 11

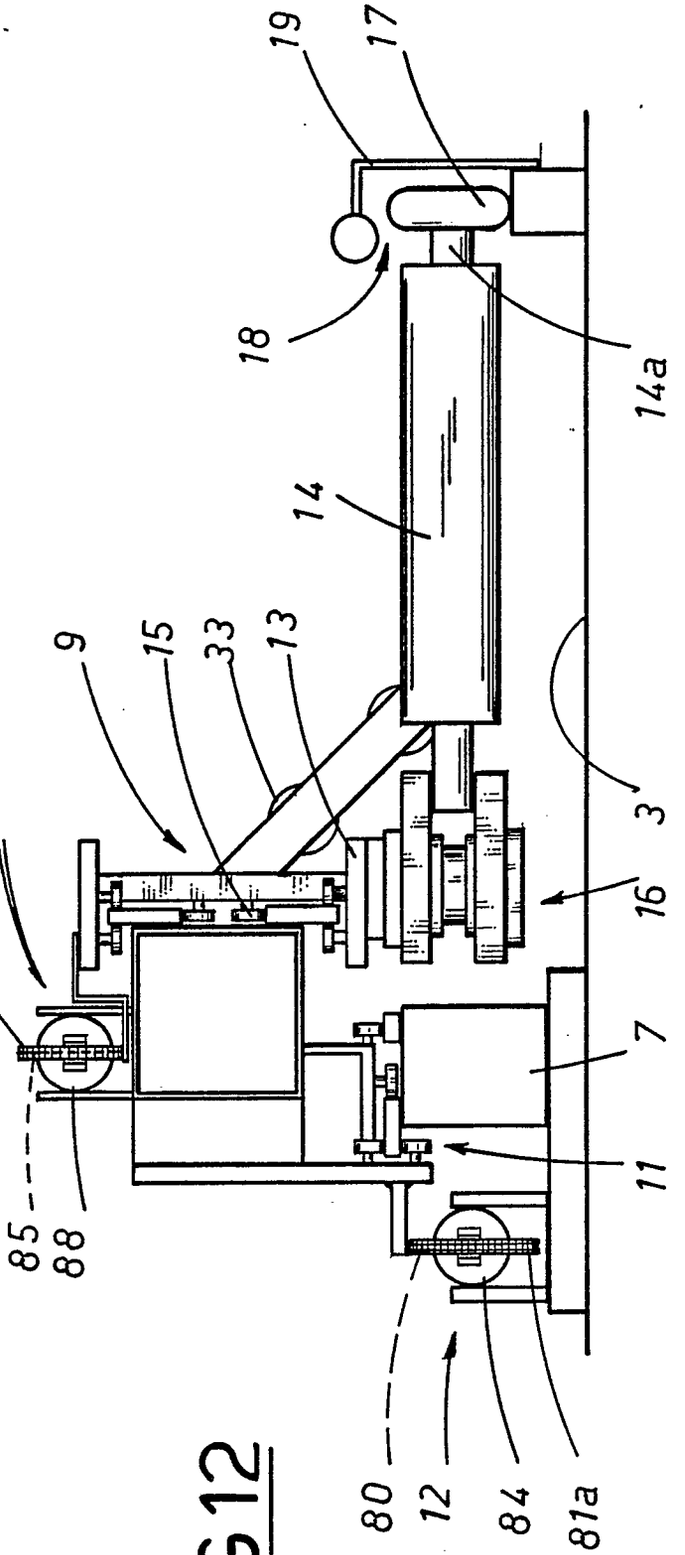

19
17
18
14a
14
9
15
33
13
3
21
16
86a
7
11
85
88
80
12
84
81a

FIG 12

FIG13a

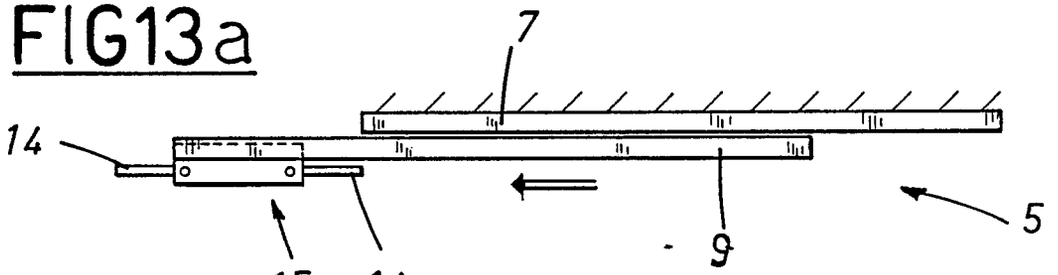


FIG13b

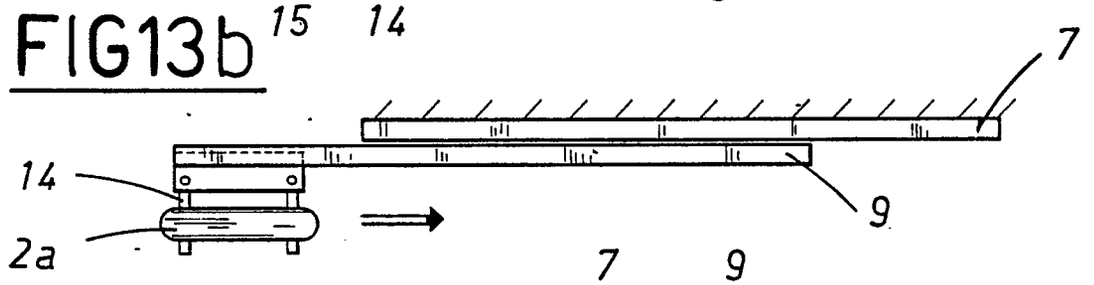


FIG13c

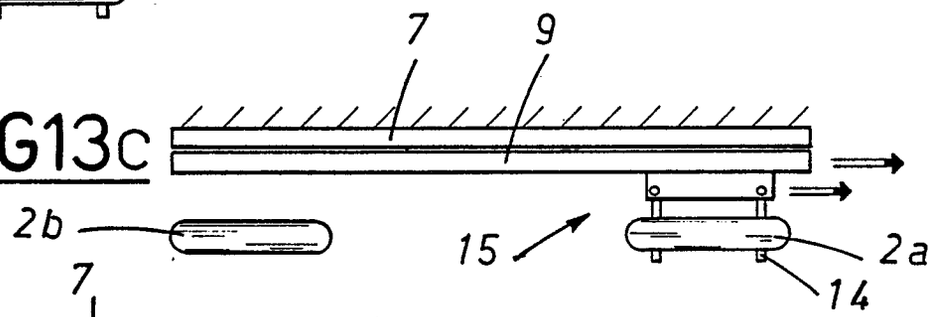


FIG14a

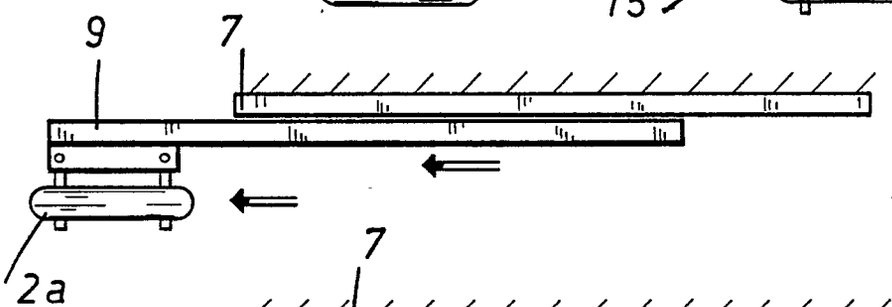


FIG14b

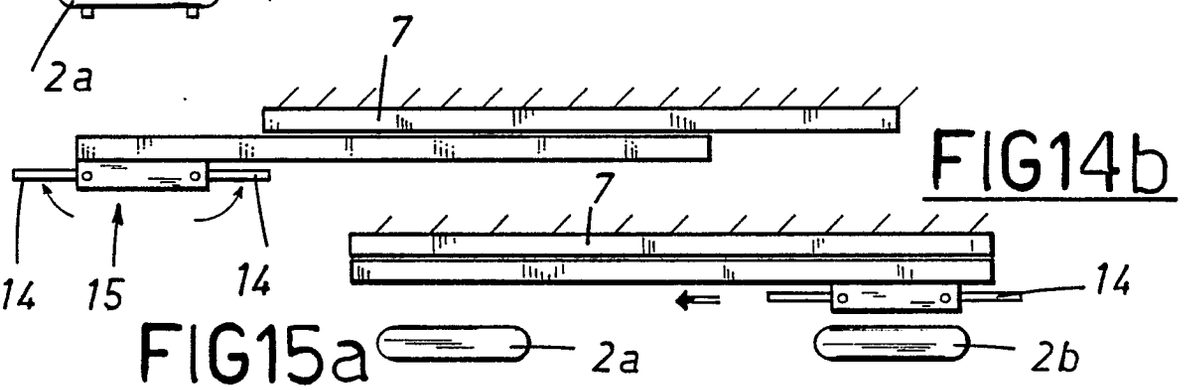


FIG15a

FIG15b

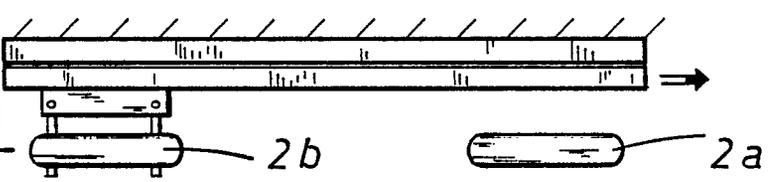
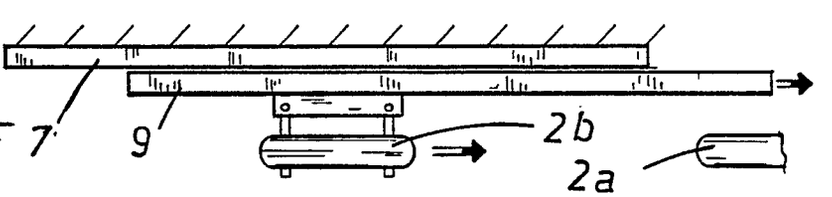


FIG15c



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 83 0181

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)
A	FR-A-1 594 647 (ROTH) * Page 4, line 1 - page 5, line 6; figures 5-7 *	1	E 04 H 6/28
A	EP-A-0 016 464 (MERCATOR GESELLSCHAFT FÜR ENTWICKLUNG UND TECHNIK) * Page 5, line 3 - page 7, line 11; figures 1-3 *	1	
A	DE-A-1 684 892 (ROTH)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 04 H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20-07-1990	PORWOLL H.P.

CATEGORY OF CITED DOCUMENTS

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