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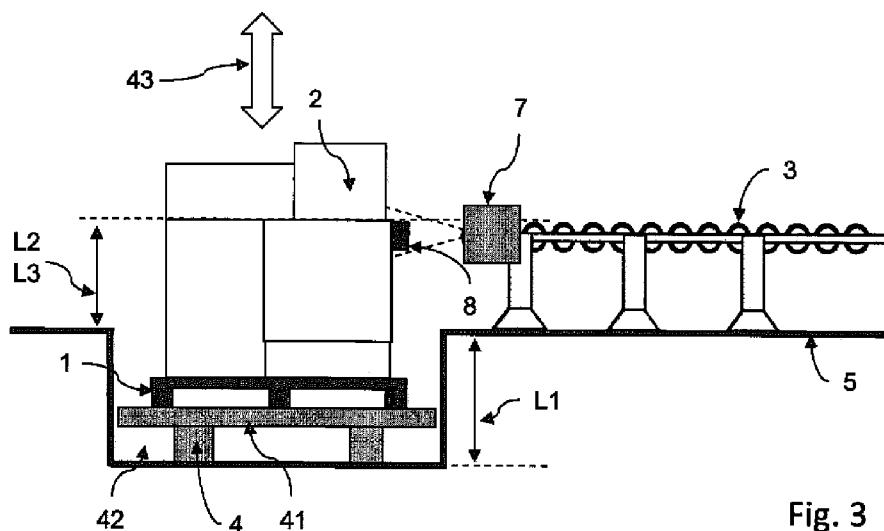


Fig. 3

(57) Abstract: The invention relates to an unload system to assist the unloading of a pallet (1) with stacked objects (2) on top of the pallet (1) comprising a platform (41) suitable to carry at least one pallet (1) on top of the platform (41), lifting means (4) to lift the vertical position of the platform (41) to an unload level (L2) for a topmost object (2) essentially equal to a loading level (L3) of a transport means (3) to move the topmost objects (2) in an essentially horizontal direction (6) to the transport means (3), and at least one position means (8, 81, 82) separate from the objects to indicate the unload level (L2) to the lifting means (4) and to a method to unload a pallet (1) according to the present invention.

Unload system

5 **Field of the invention**

This invention relates to an unload assistant suitable to unload a pallet with multiple loaded objects and to a method for operating the unload assistant.

Background of the invention

10 Document EP0283042 discloses a loading system to load a pallet with objects from a transport belt. The objects are transferred from a transporting belt to a lifting platform, which vertical position is aligned to the level of the transport belt. After loading the object to the lifting platform, the lifting platform is lowered to align the upper surface of the loaded object to the level of the transport belt and the next object is loaded on top of the previous
15 object. To adjust the position of the lifting platform in order to align the upper surface of the loaded object to the level of the transport belt, sensors arranged on the transport belt to measure each height of the to-be-loaded objects on the transport belt. The measuring system is applicable to single objects transported separately on top of a transport belt. Unfortunately this system is not applicable to unload a pallet loaded with stacked objects.

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There is no a support system available for unloading any pallets in order to prevent workers from carrying too heavy objects or objects in non-ergonomic positions and/or to decrease the required time for unloading a pallet.

25 **Summary of the invention**

It is an object of the present invention to provide an unload system preventing workers from carrying too heavy objects or objects in non-ergonomic positions during the unload process of any pallets and to decrease the required time for unloading a pallet.

30 The object is solved by an unload system to assist the unloading of a pallet with stacked objects on top of the pallet comprising a platform suitable to carry at least one pallet on top of the platform, lifting means to lift the vertical position of the platform to an unload level for an topmost object essentially equal to a loading level of a transport means to move the topmost object in an essentially horizontal direction to the transport means, and
35 at least one position means separate from the objects to indicate the unload level to the lifting means.

The lifting means to adapt the vertical position of the platform may be any suitable means to move the platform with loaded pallets on top of it upwards or downwards. As an example the lifting means may be a hydraulic hoist or hydraulic actuators. Alternatively the platform may be lifted by an electric motor or electric actuator or any other hoist motor or a spindle. In a preferred embodiment, the lifting means should be able to lift also heavy pallets of at least 900 kg (loadable weight of an EU pallet). People skilled in the art are able to choose suitable lifting means within the scope of this invention. The vertical adjustment of the platform is controlled by the interaction of the position means indicating the desired unload level and the lifting means changing the vertical position of the platform in accordance to the indication provided by the position means. .

The unload level denotes the distance between the floor (or floor level) and the bottom surface of the topmost object of the objects stacked on top of the pallet. The topmost object denotes the object on top of the stacked objects. The loading level of the transport means denotes the distance to the floor or floor level (or height above the floor) which corresponds to the level of the upper surface of the transport means. The bottom surface of the object is moved along the upper surface of the transport means. The vertical movements of objects during unloading the pallet (moving of objects from the pallet on top of the transport means) shall be minimized, preferably avoided. Here the transport means is at least one element of the group of conveyor belt (e.g. rubber conveyor belt), roller belt, chute or combinations thereof as used in automatic distribution systems as a labor saving system that allows large volumes to move rapidly.

The term "essential" denotes acceptable deviations between the level of the bottom surface of the topmost object to be unloaded from the pallet and the loading level of the transport means not causing any significant additional effort to move the objects to the transport means. A deviation of a few centimeters, for example 1cm, 2cm, 5cm, is considered as acceptable in order to unload objects essentially horizontal.

The term "separate from the objects" denotes a position means, which is not permanently fixed to the objects. The position means may be arranged apart from the objects or attached to the objects only for a short time during the unload process, e.g. a detachable indicator. The use of a separate position means allows to apply the unload system to arbitrary pallets and objects regardless of the presence of any kind of dimension information on the pallets or objects, e.g. permanently attached dimension information.

In an embodiment the position means is suitable to provide a control signal to the lifting means comprising control means suitable to receive the control signal and to control the lifting means to adjust the vertical position of the platform according to the control signal. A position means (or position sensor) is any device that permits a position measurement.

- 5 It can either be an absolute position means or a relative one (displacement means).

The control signal may be any signal suitable to be used to control the lifting means in order to lift the platform. The control signal may be an electrical, optical or electromagnetic signal or any other kind of suitable signal. The control means is any means suitable to control the lifting means in order to lift the platform.

- 10 In another embodiment the control means comprise a transducer to receive the control signal and to provide an adjustment signal, and preferably further comprising a computer to analyze and/or to process the adjustment signal. The transducer may denote any kind of transducer as a receiver for the control signal provided by the position means further converting the control signal or a physical attribute of the control signal into an adjustment
- 15 signal to adjust the vertical position of the platform. The adjustment signal may be transferred directly to the lifting means or preferably be analyzed and further processed by a computer as part of the control means to control the lifting means in order to adjust the vertical position of the platform to equal the unload level of the topmost object and loading level of the transport means.
- 20 In another embodiment the position means is at least one emitter of the group of IR emitters, RF emitter, light reflectors, LED arrays, linear variable differential transformer, proximity sensor, or transponder, especially RFID transponder. The position of the position means can be detected, if the position means emits a control signal, for example an optical or electromagnetic signal. The optical or electromagnetic signals can be a radio
- 25 frequency (RF) signal, a infrared (IR) signal, visible light reflected from a reflector as the position means, a light signal emitted from a light source like a LED or an array of LEDs or a signal emitted from a transponder. The control signal is received by the control means or by receiving means as part of the control means, for example by three or more transducers. The transducers for example are antennas, photo sensors, RF sensors or IR
- 30 sensors. The signal received by the receiving means or transducers is analyzed in order to determine the position of the position means. People skilled in the art will apply common techniques to calculate the position of the position means from the control signals received by three or more transducers or other receiving means within the scope

of this invention.

Common transponders receive a signal from another signal emitter and response to this signal on a predetermined frequency, preferably in a coded manner. RFID transponders are one group of transponders used in logistic processes. Such transponders may be LF
5 transponders emitting at frequencies below 135kHz with an operating distance of 1.5m, HF transponders emitting frequencies between 3 and 30 MHz and an operating distance of 1.2m, UHF transponders emitting frequencies of 200MHz to 2GHz with an operating distance of 3-7m and MW transponders emitting at frequencies larger than 2GHz with an operating distance up to 2m. These transponders can be used in different environments.
10 The operating distance is sufficient for the use of these position means within the unload system according to the present invention.

In an embodiment the position means is portable. This allows a dynamic positioning of the position means to locations, where the position means easily can indicate the unload level to the lifting means. The use of a portable position means allows to apply the unload
15 system to arbitrary pallets and objects regardless of the presence of any kind of dimension information on the pallets or objects, e.g. permanently attached dimension information. In a preferred embodiment the position means comprises an adhesive layer, a glue layer or a Velcro fastener or any other suitable removable means, preferably to be attached or detached from objects or workers. The position means can be attached to the
20 topmost object close to the unload level or close to the upper surface of the object directly beneath to topmost object to be unloaded at a side, which is suitable to receive and / or to emit a control signal to the control means, preferably the side of the object facing towards the transport means. The latter location of the attached position means is preferred, because the position of the position means does not vary during the unload process of the
25 topmost object and the position means remains at the objects stored on top of the pallet. The position means may be attached to this object in a detachable manner. In this case, the platform will be lifted until the position means is at the unload level and the topmost objects can be moved to the transport means in an essentially horizontal direction without additional effort to lift or carry the objects by workers. Worker will detach the position
30 means after unloading the topmost objects and attach the position means as described above again to the upper surface of the object directly beneath to topmost object, which was formally the object beneath the topmost object. This procedure repeats until the pallet

is empty. The position means may also comprise a verification button in order to start the adjustment of the platform only on demand.

- Alternatively, the position means can be attached to the worker itself approximately at the same levels as before described when attached to the objects. The procedure to lift the platform follows the same principal only with a different location of the position means. The different location denotes the manner where the position means is attached to, not the height level of the position means above floor level. In case of attaching and detaching the position means to the worker, the worker preferably wears clothes comprising Velcro fasteners suitable to attach position means to it. The advantage is, that workers do not have to come too close to the moving pallet and the platform cavity, which improves the security of the workers. Preferably, the lifting means adjust the vertical position of the platform only in cases, where the location of the position means is changed significantly or exceeding a certain threshold. In this case small movements of the worker with attached position means is not interpreted as a new desired vertical position of the platform.
- Alternatively, the position means may comprise a verification button to be pressed to start the adjustment of the platform to a different position.

- In another embodiment the position means is a linear variable differential transformer, a proximity sensor or a touch sensor. A proximity sensor is to detect the presence of nearby objects without any physical contact. A touch sensor recognizes the position where the sensor is touched. The object being sensed is often referred to as the proximity or touch sensor's target, for instance a finger of a worker. Proximity and touch sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack or minimized of physical contact between sensor and the sensed object. A worker can indicate the unload level by approaching a finger to the proximity sensor or touching the touch sensor with a finger at a position corresponding to the bottom surface (or lower surface) of the topmost object stacked on the pallet. From the indicated location of the bottom surface of the topmost object and the known height of the transport means, the lifting means is able to adapt the vertical position of the platform in order to equal the unload level of the topmost object to the loading level of the transport means. A corresponding solution is the application of a linear variable differential transformer (LVDT) commonly used for detecting absolute distances. The transformer is moved along a vertically aligned cable or rope to the position of the bottom surface of the topmost object. With the determined height of the LVDT and the known height of the transport

means (loading level), the lifting means is able to adapt the vertical position of the platform in order to equal the unload level of the topmost object to the loading level of the transport means.

5 In an embodiment the LDTV or proximity sensor is arranged vertically with a height at least of the loading level, preferably close to the transport means. Here the proximity sensor or the LVDT is arranged as a variable vertical position means, where any position of the unload level can be indicated randomly in accordance to the present specific lower surface of the topmost object to be unloaded from the pallet. Such an arrangement can be used for a large variety of different sizes and heights of pallets and transport means.

10

In an embodiment the lifting means is arranged in a cavity suitable to lower the vertical position of the platform below a floor level for stacked pallets with a height higher than the loading level. Stacked pallets carry several objects. The height of stacked pallets usually exceeds the height of the loading level of any neighbored transport means for unloading the pallet. Therefore a cavity is required to adjust the topmost objects on a stacked pallet to the loading level of the transport means by lowering the platform level beneath the floor level. The floor level denotes the location of the surface of the floor.

20 In an embodiment the transport means comprises moving means suitable to move the transport means close to the objects to be unloaded. After adjusting the vertical position of the platform to a level, where the lower surface of an object equals the loading level of the transport means, the objects only have to be pushed or pulled from the pallet towards the transport means without any further effort or vertical movements. A worker does not have to support the object to bridge a gap between pallet and transport means, because the gap is closed by moving the transport means towards the pallet. Here, the transport means is be at least one element of the group of conveyor belts, roller belts, chutes or combinations thereof.

30 The lifting means for the platform may comprise at least one element of the group of hydraulic actuators, electric actuators, spindles, hoist motors. In another embodiment, the lifting means are furthermore suitable to tilt the platform of a tilting angle towards the transport means in order to facilitate the moving of objects from the pallet to the transport means. If the objects on a loaded pallet are stacked on top of each other, the objects have to be moved towards the transport means essentially horizontally to prevent the workers

- from carrying too heavy objects. To move a stacked object workers have to apply a sufficient force to overcome the static friction between the stacked objects. With a horizontal aligned platform, the static friction is proportional to weight of the object times the static friction coefficient. Tilting the platform of a tilting angle, which is the angle
- 5 between the horizontal position and a tilted position of the platform, lowers the force to be applied to move an object towards the transport means. The tilting angle shall be large enough to support the movement of objects, but not too high to prevent slippage of loaded objects. The weight of objects cannot be determined by image recognition systems without any information carrier attached to the individual objects. Suitable information
- 10 carriers providing weight informations are e.g. barcodes, RFID tags or differently colored stripes indicating a certain weight or range of weights. The weight information may be used to adjust the tilting angle in order to provide support for unloading the objects without introducing a risk of slippage.
- 15 In a preferred embodiment, the platform comprises fixation means or a cover at least partly covering the platform at least partly made of a material with a high static friction coefficient to prevent the pallet from slippage on the tilted platform. Suitable fixation means are any means to prevent a slippage of the pallet on top of the tilted platform such as blocks, protruding edges, pins, etc brought into mechanical contact with the pallet in
- 20 order to prevent any movement of the pallet in a tilted position of the platform. The friction coefficient between wood as a common pallet material and steel as one example of a platform material is 0.5. The static friction coefficient between wood and wood is 0.65, between steel and steel it is 0.15. To avoid a slippage of the pallet the platform may be coated with slip-reducing or slip-free materials, e.g. rubber, or equipped with a slip-
- 25 reducing or slip-free underlay. People skilled in the art are able to select a suitable coating or underlay to prevent or reduce slippage of pallets due to tilted platforms.

The invention further relates to a method to unload a pallet using an unload system according to the present invention, comprising the steps of

- 30
- placing a pallet with loaded objects on top of a platform,
 - indicating an unload level for an topmost object by a position means,
 - adjusting the vertical position of the platform in order to essentially equalize the unload level to a loading level of a transport means in accordance to the indicated unload level,
- 35
- moving the topmost object in an essentially horizontal direction to the

- transport means, and
- repeating steps two and three until the pallet is unloaded.

The term "essential" denotes acceptable deviations between the level of the lower surface
5 of the topmost object and the loading level of the transport means not causing any
significant additional effort to move the objects to the transport means. A deviation of a
few centimeters, for example 1cm, 2cm, 5cm, is considered as acceptable in order to
unload objects essentially horizontal.

- 10 In an embodiment the step of indicating the unload level comprises the step of
- attaching the position means to the topmost object or the object beneath
the topmost object, preferably to the object beneath the topmost object
close to its upper surface, or
 - attaching the position means to a worker at a suitable position to indicate
15 the unload level.

The position means can be attached to the topmost object close to the unload level or
close to the upper surface of the object directly beneath to topmost object to be unloaded
at a side, which is suitable to receive and emit or to emit a control signal to the control
20 means, preferably the side of the object facing towards the transport means. The latter
location of the attached position means is preferred, because the position of the position
means does not varied during the unload process and the position means remains at the
objects stored on top of the pallet.

- 25 In another embodiment the step of indicating the unload level comprises the step of
- approaching or touching a proximity sensor or touch sensor at a level
corresponding to the bottom level of the topmost object, or
 - adjusting a linear variable differential transformer at a level corresponding
to the bottom level of the topmost object.

30 The unload level is the level of the bottom surface of the topmost object. From indicating
this level with one of these sensors arranged close to the worker and/or the transport
means, the unload assistant, preferably the control means of the unload assistant
preferably comprising a computer, calculates the required vertical adjustment of the
platform from the current position of the platform, the indicated unload level of the topmost
35 object and the known height of the transport means. Here no further receiving means are

required, because the control signal contains already the height information of the unload level.

The above discussed embodiments are only examples. Skilled people may consider
5 modifications of said embodiments within the scope of this invention. More details of the invention are shown in the following figures and the detailed description of embodiments.

Brief description of the drawings

- Fig.1: unload system according to the present invention, with (a) the platform with pallet
10 to be unloaded, (b) lowered position of the pallet to unload the topmost objects to the transport means, (c) higher position of the platform in order to unload the next level of objects to the transport means, and (d) even higher position of the platform to unload the lowest stacked objects on top of the pallet.
- Fig.2: stacked objects with position means reversible attached to the objects.
- 15 Fig.3: unload system according to the present invention with control means.
- Fig.4: position means attached to a worker.
- Fig.5: unload system according to the present invention with position means apart from the objects.
- Fig.6: unload system according to the present invention with moveable transport means.
- 20 Fig.7: unload system according to the present invention with tilted platform with (a) a coating on top of the platform and (b) with a fixation means to prevent slippage of the pallet on top of the platform.

Detailed description of embodiments

- 25 Fig.1 shows a unload system according to the present invention, with (a) the platform 41 with a pallet 1 to be unloaded and a position means 8 attached close to the upper surface of the object beneath the topmost object 2 to be unloaded, (b) lowered position of the pallet 1 to unload the topmost objects 2 to the transport means 3 according to the indicated unload level L2 be the position means 8, (c) higher position of the platform 41 in
30 order to unload the next level of objects 2 to the transport means 3 after detaching the position means 8 from the first position and attaching the position means 8 again close to the upper surface of the object beneath the currently topmost object 2 to be unloaded now, and (d) even higher position of the platform 41 to unload the lowest level of objects 2 on top of the pallet 1 with position means 8 now attached close to the upper surface of the
35 pallet 1. The platform 41 is moved by lifting means 4 upwards and/or downwards along

the moving direction 43 depending on the dimensions of the pallet 1, the stacked objects 2 and the transport means 3. Usually the height of the stacked pallet exceeds the height of the upper surface of the transport means 3 above the floor level 5, indicated as loading level L3. The lifting means 4 adjust the platform 41 in order to equal the height of lower surface above floor level of the topmost object L2 to the loading level L3. To be able to perform this adjustment even for high stacked pallets 1, the lifting means 4 are arranged in a cavity 42 with a suitable depth L1. People skilled in the art are able to choose L1 in accordance to the known common pallet sizes and heights. The curved arrow in figure 1a indicates the required movement of objects during the unload process in case of no level adjustments with an unload system according to the present invention. In figures 1b to 1d, where a level adjustment is applied, the objects 2 can be unloaded towards the transport means 3 only by horizontal movements 6 avoiding any non-ergonomic positions and/or movements of workers unloading the pallet 1. The movements 6 may be horizontal or essentially horizontal. The latter term denotes movement in case of slightly misadjusted levels L2 and L3 without any negative impact on the desired ergonomic unload process. As an example, a misalignment of L2 and L3 in the order of a few centimeters will not be notice by workers during the unload process and is still be considered as sufficiently well aligned levels L2 and L3. The term "close to the surface" denotes a distance between the exact position of the bottom surface of the topmost object and the position means in the order of a few centimeters, for instance 1cm, 2cm or 5cm.

Fig. 2 shows as an example position means 8 attached close to the bottom surface of the topmost object 2 and alternatively attached close to the upper surface of the object beneath the topmost object 2 to be unloaded to indicate the unload level L2 to the unload system. As an example position means 8 are RFID transponders. The position means comprise an adhesive layer in order to be attached and detached reversibly from objects many times.

Fig. 3 shows the unload system according to the present invention with control means 7 suitable to receive the control signal from the position means. The control means 7 may be on one side of the pallet 1, or on two or more sides of the pallet 1. In the example, the control means 7 are arranged at the transport means 3 facing towards the pallet 1. In other embodiments there may be more control means to determin the position of the position means 8. The control means 7 controls the lifting means to adjust L2 and L3 to the same level.

Fig. 4 shows another embodiment of the unload system, where the position means 81 is attached to a worker 9, who has to move the topmost objects along the essentially horizontal direction 6 to the transport means 3. The position means 81 may be attached to the worker 1 by a Velcro fastener or other suitable means. The Velcro fastener may be
5 arranged as a stripe on the clothes of the worker extending from the shoes to the shoulder of the worker to enable an attachment of the position means 8 at any required height to indicate the unload level L2.

Fig.5 shows an embodiment with two different kinds of position means 81, 82. For the
10 operation of the unload system, at least one kind of position means is required. The two kinds of position means 81, 82 in figure 5 shall illustrate the variability of the unload system. One embodiment of the position means is the position means 81 as shown in figure 4 attachable to the worker 9. The other embodiment is a proximity or touch sensor 82 as the position means, where the worker 9 can indicate the unload level by touching
15 the touch sensor 82 (or approaching the proximity sensor 82) with his finger at a height position corresponding to the unload level L2 of the topmost object 2. The lifting means 4 adjust the vertical position of the platform 41 in the same manner as described for figure 1a-d. The sequence to indicate the next unload level L2 and the subsequent unloading process follows the same principal as described under figure 1a-d.

20 Fig. 6 shows another embodiment of the unload system, where the transport means 3 is not fixed to the floor 5, but can be moved towards 32 the pallet 1 to unload the pallet 1 and backwards 32 after completed unloading of the pallet 1 in order to replace the empty pallet 1 by another loaded pallet 1 with stacked objects 2 on top of it. The moving means
25 31 in order to move the transport means 3 may comprise any suitable moving means, e.g. rolls, wheels, guide rails or tracks. The moving means may allow moving directions 32 in a one dimensional or two dimensional manner. The position means is not shown here for ease of understanding.

30 Fig. 7 shows the unload system of figure 2 with the additional opportunity to tilt the platform 41 within the cavity 42 by a tilting angle α . Here the movement 6 to unload the objects 2 towards the transport means 3 is further supported by the downhill-slope force acting on the objects 2 in case of a tilted platform 41. Especially with tilted platforms 41, a movable transport means 3 is advantageous, because the distance between stacked
35 objects and the transport means 3 depends on the tilting angle α . To avoid a disturbing

gap between objects 2 and transport means 3, the transport means may be moved towards or backwards along the moving direction 32 to minimize the gap between objects 2 and transport means 3. The platform may further comprise anti-slippage means at least partly covering the surface of the platform at least partly made of material with a high static friction coefficient, such as rubber or rough plastic. Alternatively the anti-slippage means are permanently attached to the side of the top surface of the platform facing towards or neighboring the transport means, for example may be any kind of bars or blocks made of a pressure resistant material such as metal, hard plastic or wood. The position means is not shown in figure 7 for ease of understanding.

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The shown embodiments must not be considered as limitation of the invention. The discussed embodiments are only examples of the present invention. People skilled in the art may consider alternative embodiments of the previously disclosed invention still falling into the scope of this invention.

15

LIST OF NUMERALS

	1	pallet
	2	objects
5	3	transport means
	31	moving means of transport means
	32	moving direction to move the transport means
	4	lifting means
	41	platform
10	42	cavity for lifting means
	43	moving directing of lifting means
	5	floor level
	6	unload direction to unload objects
	7	control means
15	8	separate position means reversible attached to objects
	81	separate position means attached to a worker apart from the objects
	82	separate position means as a vertical proximity or touch sensor
	9	worker
	L1	distance between floor level and bottom level of cavity for lifting means
20	L2	distance between floor level and lower surface of loaded objects
	L3	loading level of the transport means
	α	tilting angle of platform

CLAIMS

1. An unload system to assist the unloading of a pallet (1) with stacked objects (2) on top of the pallet (1) comprising a platform (41) suitable to carry at least one pallet (1) on top of the platform (41), lifting means (4) to lift the vertical position of the platform (41) to an unload level (L2) for an topmost object (2) essentially equal to a loading level (L3) of a transport means (3) to move the topmost objects (2) in an essentially horizontal direction (6) to the transport means (3), and at least one position means (8, 81, 82) separate from the objects to indicate the unload level (L2) to the lifting means (4).
2. The unload system according to claim 1, characterized in that the position means (8, 81, 82) is suitable to provide a control signal to the lifting means (4) comprising control means (7) suitable to receive the control signal and to control the lifting means (4) to adjust the vertical position of the platform (41) according to the control signal.
3. The unload system according to claim 2, characterized in that the control means (7) comprise a transducer to receive the control signal and to provide an adjustment signal, and preferably further comprising a computer to analyze and/or to process the adjustment signal.
4. The unload system according to any of the preceding claims, characterized in that the position means (8, 81, 82) is at least one emitter of the group of IR emitters, RF emitters, light reflectors, LED arrays, or transponders, especially RFID transponder.
5. The unload system according to any of the preceding claims, characterized in that the position means (8, 81, 82) is portable.
6. The unload system according to claim 5, characterized in that the position means (8, 81) comprise an adhesive layer, a glue layer or a Velcro fastener, preferably to be attached and detached from the objects (2) or a worker (9).
7. The unload system according to any of the preceding claims, characterized in that the position means (82) is a linear variable differential transformer (LVDT), a proximity sensor or a touch sensor.

8. The unload system according to claim 7, characterized in that the LDTV or proximity sensor is arranged vertically with a height at least of the loading level (L3), preferably close to the transport means (3).

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9. The unload system according to any of the preceding claims, characterized in that the lifting means (4) are arranged in a cavity (42) suitable to lower the vertical position of the platform (41) below a floor level (5) for stacked pallets (1) with a height higher than the loading level (L3).

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10. The unload system according to any of the preceding claims, characterized in that transport means (3) comprises moving means (31) suitable to move the transport means (3) close to the objects (2) to be unloaded.

15 11. The unload system according to any of the preceding claims, characterized in that the transport means (3) is at least one element of the group of conveyor belts, roller belts, chutes or combinations thereof.

20 12. The unload system according to any of the preceding claims, characterized in that the lifting means (4) comprise at least one element of the group of hydraulic actuators, electric actuators, spindles, hoist motors.

13. Method to unload a pallet (1) using an unload system according to claim 1, comprising the steps of

- 25
- placing a pallet (1) with loaded objects (2) on top of a platform (41),
 - indicating an unload level (L2) for an topmost object (2) by a position means (8, 81, 82)
 - adjusting the vertical position of the platform (41) in order to equal the unload level (L2) to a loading level (L3) of a transport means (3) in

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 - accordance to the indicated unload level (L2),
 - moving the topmost object (2) in an essentially horizontal direction (6) to the transport means (3), and
 - repeating steps two and three until the pallet (1) is unloaded.

35 14. Method to unload a pallet (1) according to claim 13, characterized in that the step

of indicating the unload level (L2) comprises the step of

- attaching the position means (8) to the topmost object (2) or the object beneath the topmost object (2), preferably to the object beneath the topmost object (2) close to its upper surface, or
- 5 - attaching the position means (81) to a worker at a suitable position to indicate the unload level (L2).

15. Method to unload a pallet (1) according to claim 13, characterized in that the step of indicating the unload level (L2) comprises the step of

- 10 - approaching or touching a proximity sensor (82) or touch sensor (82) at a level corresponding to the bottom level of the topmost object (2), or
- adjusting a linear variable differential transformer at a level corresponding to the bottom level of the topmost object (2).

15

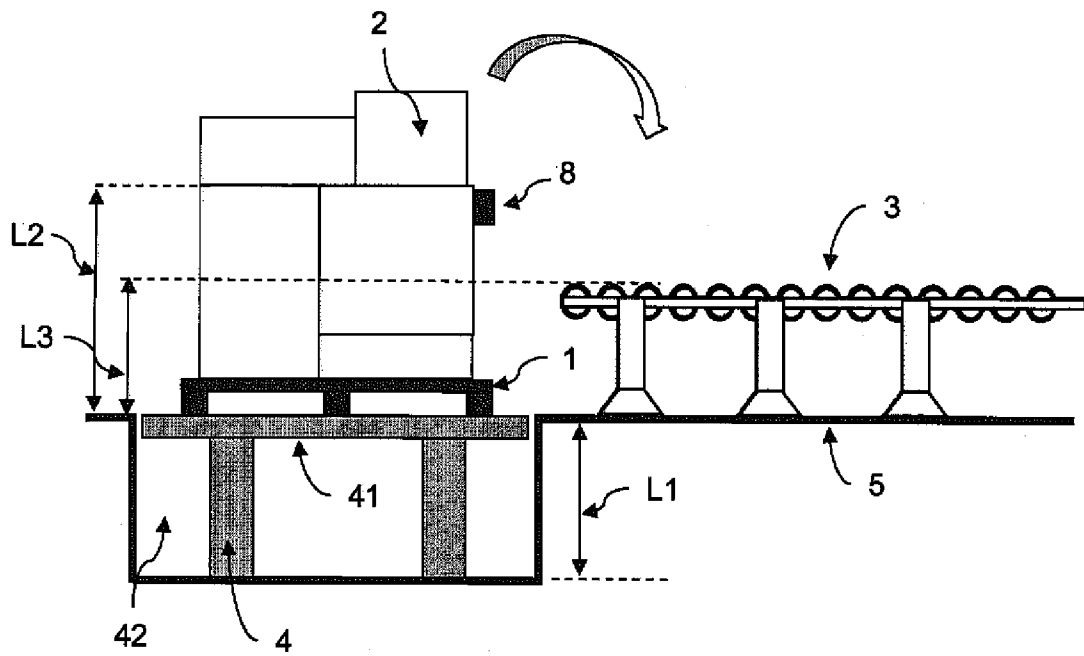


Fig. 1a

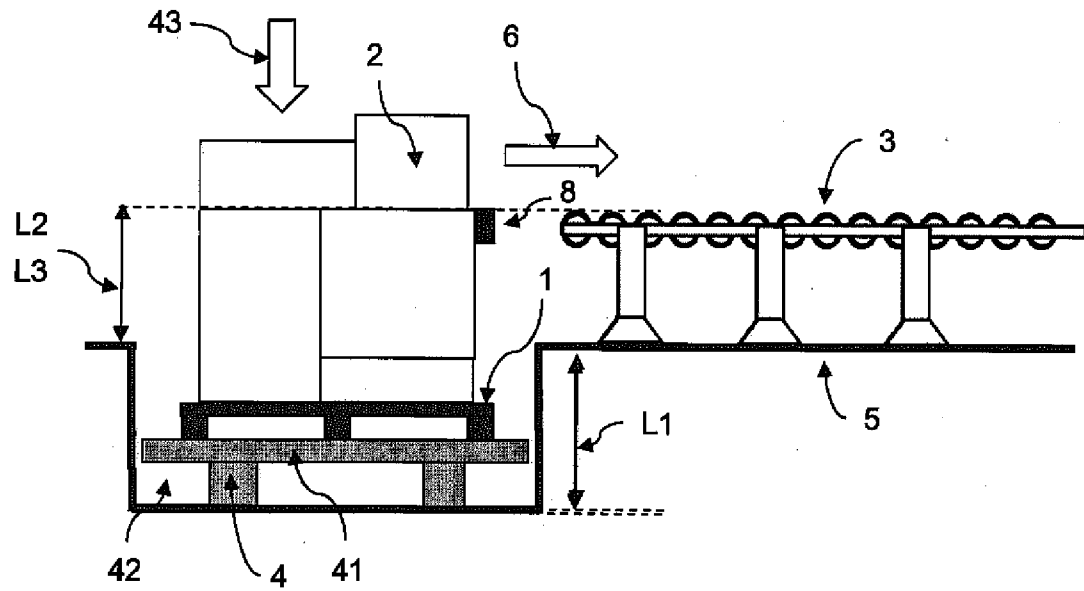


Fig. 1b

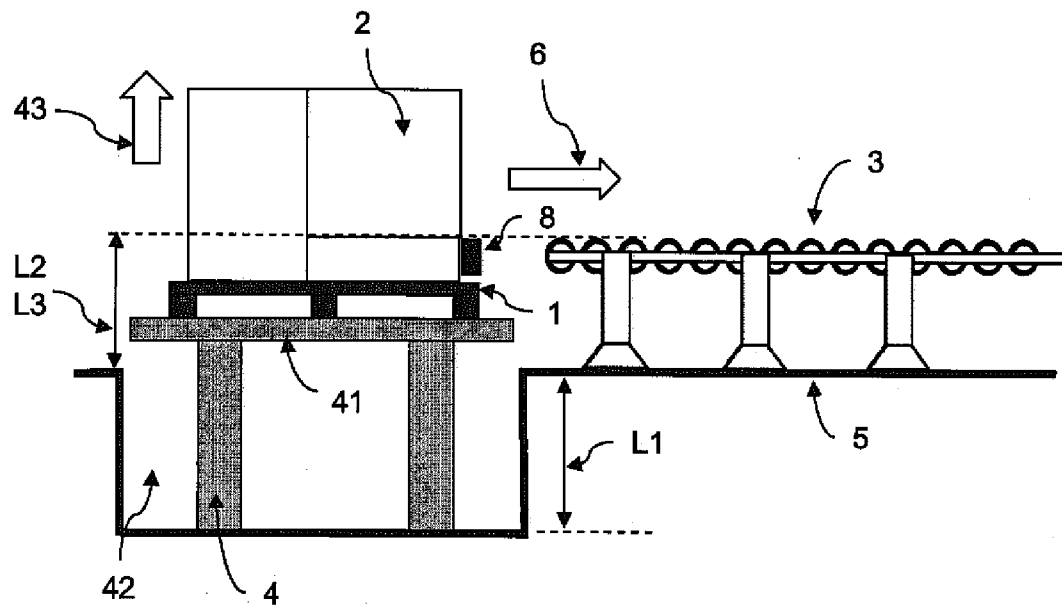


Fig. 1c

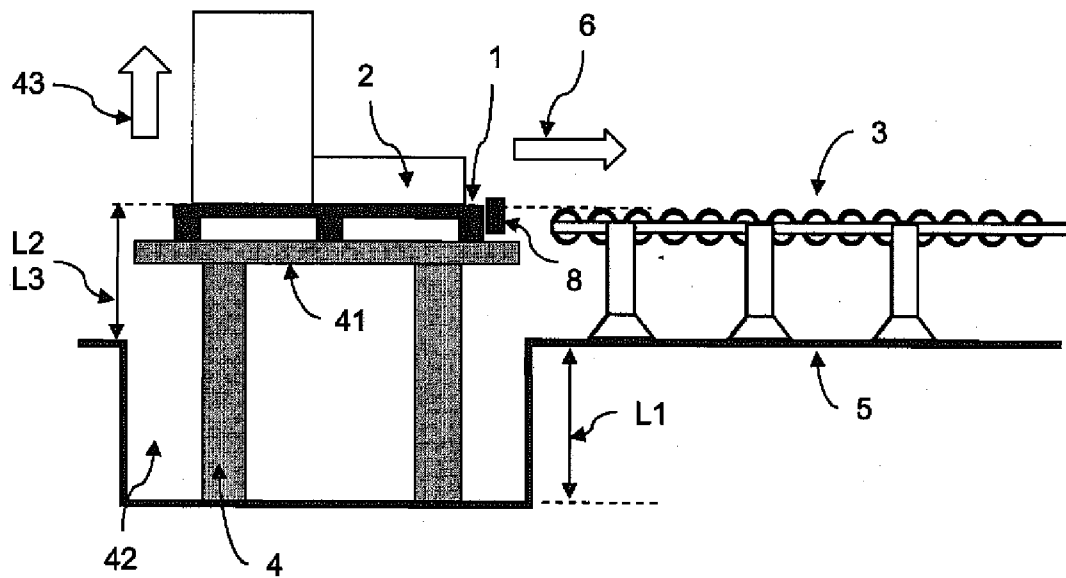


Fig. 1d

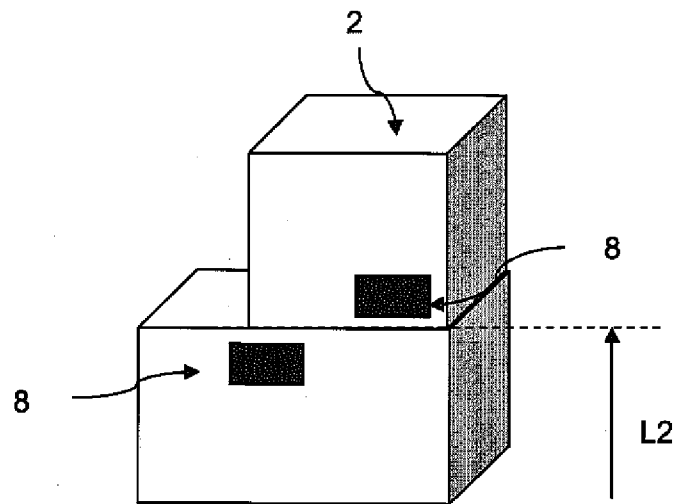


Fig. 2

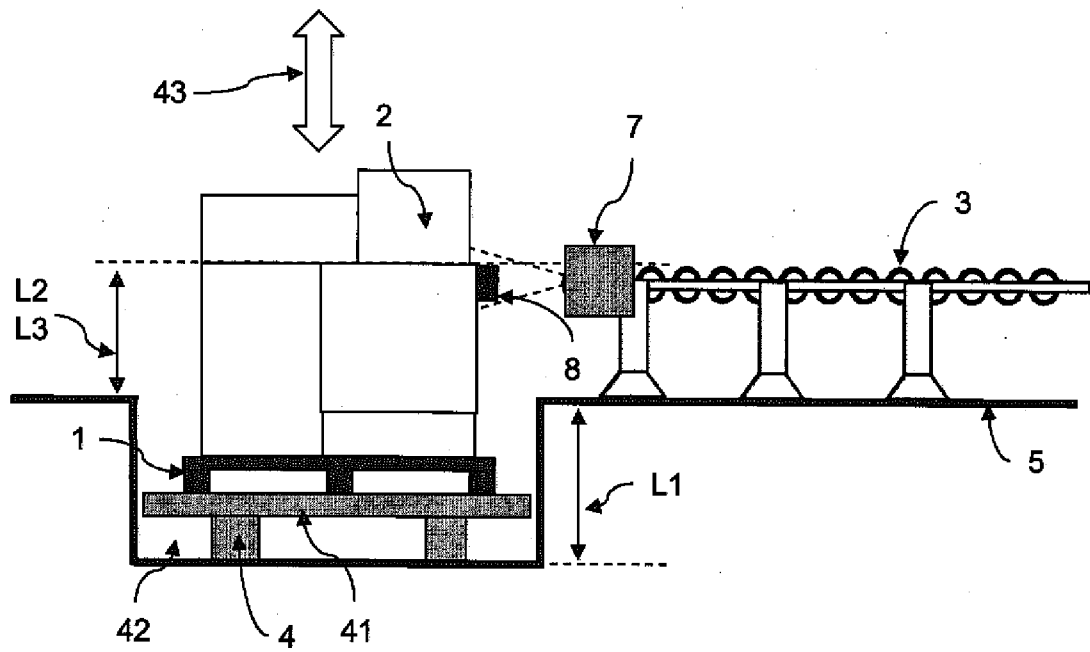


Fig. 3

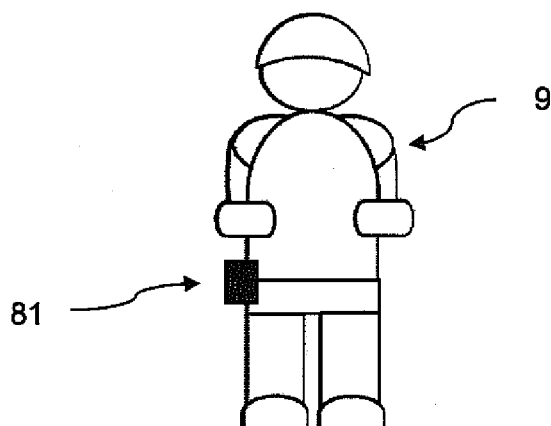


Fig. 4

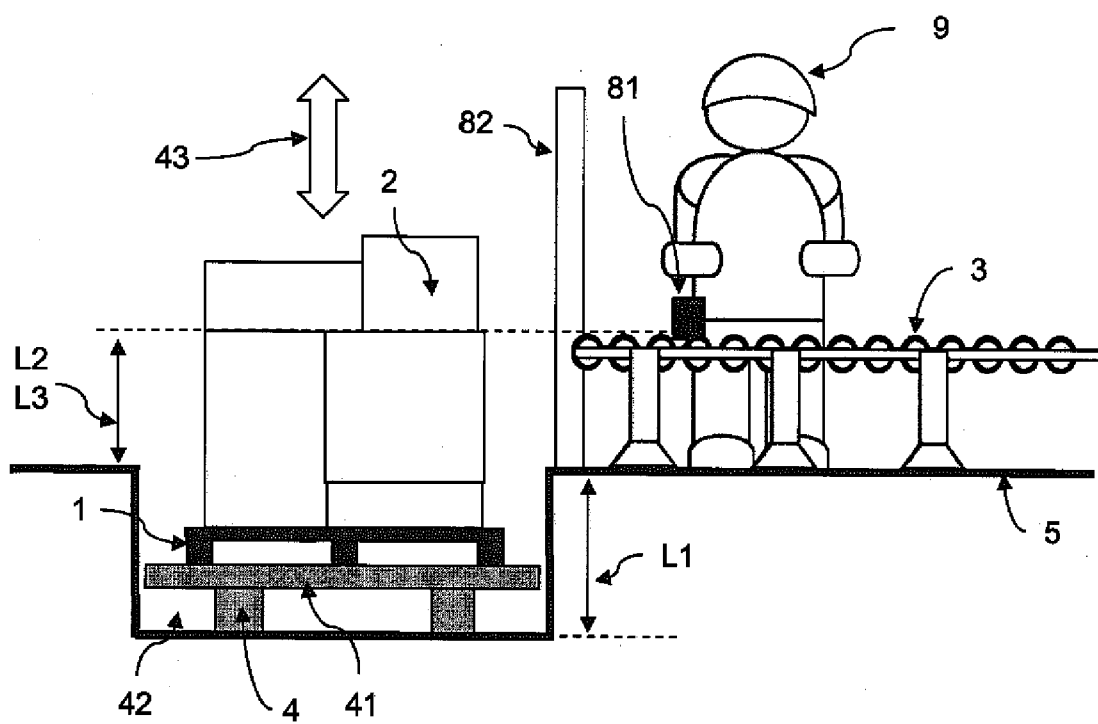


Fig. 5

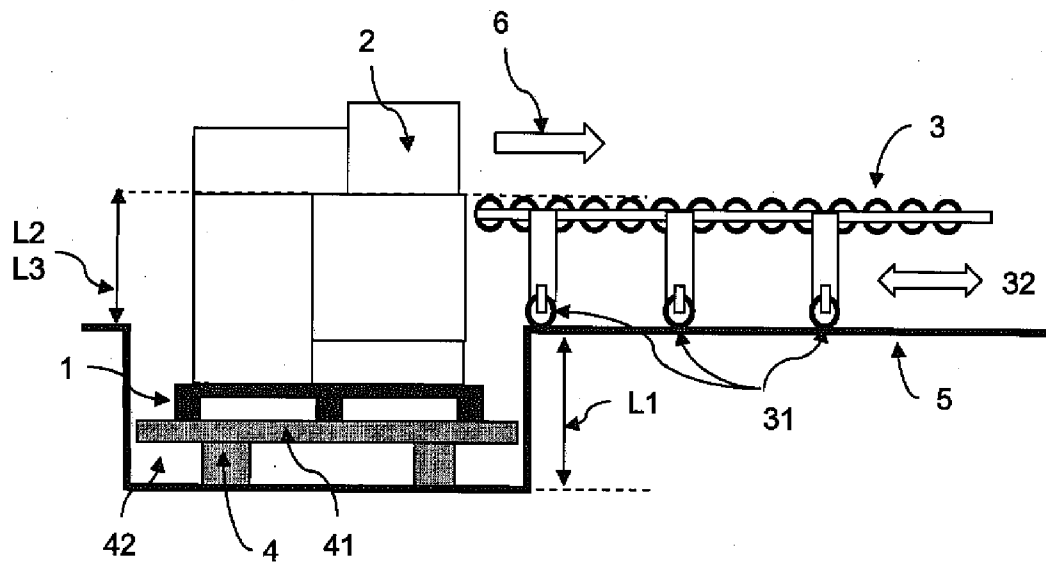


Fig. 6

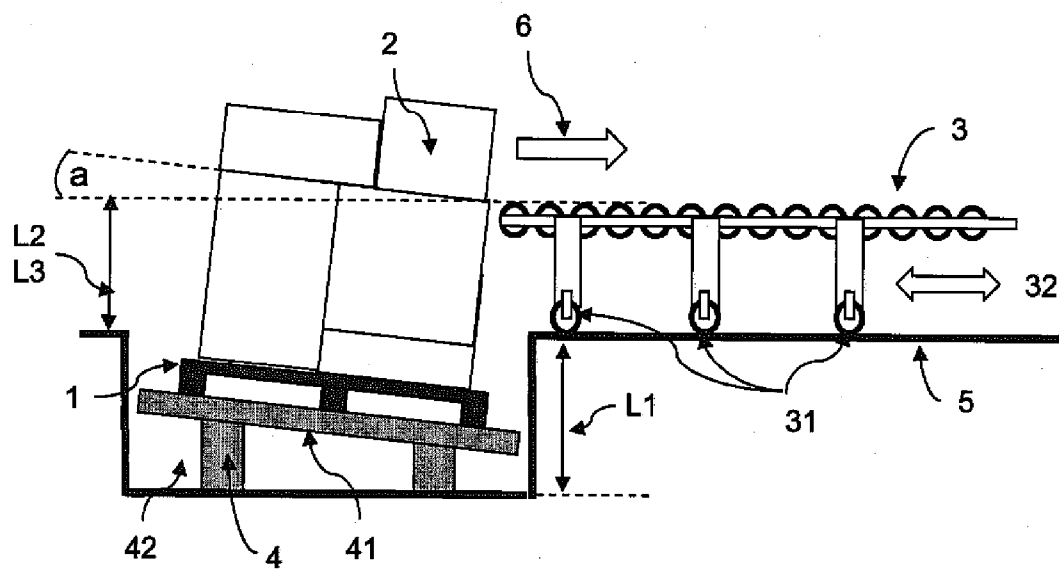


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/058713

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65G59/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NL 1 018 453 C1 (BRUBEK B V [NL]) 8 January 2003 (2003-01-08) page 7, lines 21-24; figures 1,2 -----	1,2,13
A	WO 2008/014532 A (TGW TRANSPORTGERAETE GMBH [AT]; HANSL RUDOLF [AT]; BERGMANN JOERG [AT]) 7 February 2008 (2008-02-07) page 14, line 12 - page 15, line 10; figures 1-6 -----	1-3, 10-13
A	JP 60 036224 A (SHIN MEIWA IND CO LTD) 25 February 1985 (1985-02-25) * abstract; figures 1-8 -----	1,9, 11-13
A	EP 1 213 243 A (SIEMENS AG [DE]) 12 June 2002 (2002-06-12) * abstract; figure 1 -----	1,13

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

22 September 2010

Date of mailing of the international search report

30/09/2010

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Authorized officer

Grentzius, Wim

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/058713

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JP 60036224	A	25-02-1985	NONE	
EP 1213243	A	12-06-2002	DE 10059926 A1	06-06-2002