Abstract: A hydraulic tyre stacker (4) for mounting on the lifting base (6) on a fork lift truck of the kind that comprises two mutual cooperating gripping jaws (26, 28) with continuous, unbroken, gripping plates (34) and stops (44) in the cavity (52) between the gripping jaws which is characterised in that it comprises by actuators (50) displaceable counter holds (56) oriented into said cavity, the length of the counter holds (56) corresponding with the length of the continuous, unbroken, gripping plates (34). The displaceable counter holds make the tyre stacker (4) more universal in use for different sizes of tyres in combination with an easier manoeuvrability of the tyre stacker in connection with loading/stacking of tyres under narrow conditions.
**Title: Hydraulic tyre stacker.**

The present invention relates to a hydraulic tyre stacker for mounting on a forklift truck, and comprising a releasable attached frame for mounting on a lifting base on a forklift truck, said frame comprising a first end and a second end which is pivotal by a pivotable releasable attached console on the lifting base comprising first pivotal connections and first set of actuators, the first and second side of said frame respectively comprising a first- and a second cooperating gripping jaw, said gripping jaws being symmetrical and laterally reversed, each comprising a continuous, unbroken, front gripping plate arranged parallel with the frame, said gripping plates being located in the free ends of at least two first curved organs, said organs being pivotally connected to the frame by second pivotal connections, said gripping plates being relatively displaceable towards- and away from each other by a second set of actuators, and where said pivotal organs comprises a number of counter holds, located between the pivotal connections and the gripping plates, and/or on the side of the frame adjacent to the gripping plates, the length of said counter holds being substantially equal to the length of the gripping plates.

Such a tyre stacker is known from brochure material from Danish Stacking & Loading Automatic ApS and from WO 2005/080252A1 (PCT/dk2005/000119). The tyre stacker solves a working environmental problem related to lift of large heavy pieces which are difficult to handle, e.g. it is used in connection with stacking, handling and loading of lorry tyres between storage yards, where said tyres typically are lying stacked in rows, wherefrom they are picked, stacked in lying position and loaded on lorry trailers in close packed stacks extending from floor to the ceiling of the trailer, whereupon they are transported to destruction or recycling. A single lorry tyre has a weight of approximately 70 Kg, and is therefore a considerable and almost impossible load for one person. The known tyre stacker is further saving manpower, since 1 person with a fork-lift truck provided with the tyre stacker is capable of loading a complete lorry trailer with tyres in about 1 hour, stacked as already stated, a task which normally would require 3 workers three hours to perform.

The tyre stacker is arranged for mounting on the lifting base on a forklift truck comprises a hydraulic gripping claw with two symmetrical laterally reversed hydraulic displaceable jaws which are pivotally mounted on a console and pivotal by hydraulic pistons. The free ends of the jaws are provided with continuous, unbroken, gripping plates which by the fork-lift truck can be lowered down from
above over a preferred number of tyres, where after the hydraulic operated jaws is activated, to make the gripping plates is gripping firmly around the tyres, which afterwards are lifted free from the stack, and the tyres is subsequently transported to a lorry, lorry trailer or a shelf by the truck, where the tyres by the pivotal function either may be placed stacked upon each other of arranged upstanding in rows.

However, the problem with the known tyre stacker is the varying size of lorry tyres, which sometimes might result in that the gripping claw shall be closed relatively much around the tyres to engage them sufficient to be lifted in a pile, handling narrower sizes of lorry tyres, using a gripping claw intended for larger sizes of lorry tyres.

This will in particular cause problems in connection with loading tyres on trailers or lorries as the tyres has to be loaded in piles arranged side by side abutting each other in a manner so that the tyres are not displaced during transportation, and further providing as many tyres as possible on the load surface, to minimize the transportation costs. This means practically that there is too little space for opening the gripping claw sufficient to leave the tyres in stacks without pushing the adjacent pile/piles, which causes the necessity of spending time pushing said pile/piles back in correct position.

This problem could be solved using tyre stackers with different sizes of jaws and gripping plates, but this would require relatively large investments in tyre stackers of different sizes. Another solution of the problems could comprise mounting of detachable counter holds inside the cavity of the claw locating the counter holds nearest to the gripping plates when handling narrower tyres, and moving the counter holds nearer to the pivotal points for the claw when handling larger tyre sizes. However, this solution will require a considerable time- and resource demanding change-over working, for which reason this solution is considered not preferable.

Thus it is the object with the present invention to provide a flexible solution of the above mentioned problem, which makes investment in extra tyre stackers eyed for different sizes of tyres superfluous, without needing time-consuming change-over working.
This object is achieved with a tyre stacker of the kind stated in the introduction, which is characterised in, that at least one of the counter holds at each of the gripping jaws is located on second organs, said second organs being pivot able by third pivotal connections, and displaceable towards each other by a third set of actuators, away from the first organs between the gripping plate and the pivotal connections of the first organs, into the cavity defined by the first curved organs and the gripping plates in common.

Speaking in the following text about actuators, it shall preferably be understood as hydraulic driven pistons, however it should not be understood in a manner that the inventor renounce the right to use other types of suited actuators.

It is hereby achieved that the distance between the counter holds and the gripping plates becomes adjustable activating the third actuators from the cab on the fork-lift truck, which result in that the adjustment of the counter holds placement relative to the gripping plates can take place without breaking the operation. This means that the gripping claw according to the invention becomes universal useable for practically all types and sizes of lorry tyres, making time consuming manual change-over superfluous, when changing from handling large sizes of lorry tyres to handling of smaller sizes of lorry tyres and other tyres.

By the tyre stacker according to the invention it is further achieved that at pile of tyres can be handled in a manner where the gripping plates only are introduced into the pile to attack the point where the tyres has the largest diameter and not longer, possibly even a little less if the condition of friction between the gripping plates and the surfaces of the tyres is optimal (depends on humidity and other dirt on the tread of the tyres). This means that it will be possible to locate tyres and release these from the tyre stacker without causing any mechanical action on piles of tyres located close to the pile of tyres which in spe are handled by the tyre stacker according to the invention, when tyres is loaded on a load surface on a lorry.

However, it should be noted that U.S. 2,596,477 discloses a fork-lift truck comprising a gripping device for handling of heavy cylindrical items such as paper rolls, barrels, where the gripping device comprises a frame or a console attached to the lifting base on a fork-lift truck, the gripping device comprising one hydraulic pivotal displaceable gripping jaw (23, 24, 25) (reference numbers in parenthesis in this and next paragraph refers to reference numbers in U.S. 2,596,477) cooperat-
ing with a static organ with a pivotal gripping shoe (19). The console is arranged in
a manner that the gripping device is pivotal around a horizontal oriented axis by a
hydraulic powered pivoting mechanism. The pivotal displaceable gripping jaw (23)
comprises several spatiated pivotal (23) gripping plates (24) and is therefore not
suitable for handling tyres, as the handling of tyres requires an unbroken gripping
plate in the entire extent of the gripping device. Further, the cited gripping device is
not suited for handling of tyres because of the asymmetrical movement of the
gripping jaw, which result in that it is not possible to carry out an optimal stacking
of tyres on a lorry or a load surface on a lorry trailer, since an optimal stacking of
tyres in piles only is possible by perpendicular approach relative to the orientation
of the load surface of the trailer. The cited gripping device is therefore considered
as unemployable for stacking and handling tyres.

Further the cited gripping device comprises only one single displaceable
counter hold with a limited extend suited for securing a certain counter hold on the
cylinder shaped bodies/paper rolls etc. to prevent these slipping out of the grip
between the gripping shoe (19) on the static organ and the gripping shoe (24) on
the pivotal organ (23) during handling. The counter hold is by a pivotal bearing
(31) attached to the console (12), and connected with the pivot connection for the
pivotal hydraulic displaceable organ (23) by a bar system (33, 34) and via a bar
connection (35) attached to the hydraulic cylinder (26) for displacing said pivotal
organ (23) in a manner that the extent of the displacement of the counter hold in
the direction of the gripping shoes (19, 24) is dependent of the degree of dis-
placement of the hydraulic pivotal organ (23).

However, the extent of the counter hold is limited and will thus not cover the
whole extent of the gripping device, and consequently will the counter hold as dis-
closed in U.S. 2,596,477 will not be useable in connection with the stacking of
tyres, since the stacking device according to the present invention is intended for
stacking of a plurality of tyres at the time, which will require that the length of the
displaceable counter hold should correspond to the length of the gripping plates.
To achieve an optimal handling of tyres with the tyre stacker according to the in-
vention, it is further necessary that the location of the displaceable counter holds is
independent of the position of the gripping jaws. A counter hold as the one stated
for the gripping device disclosed in U.S. 2,596,477 is thus totally inapplicable with
the tyre stacker according to the present invention.
In connection with handling of used tyres occurs some working operations sorting and arranging the tyres, typically standing upraised in long rows and in several layers. For this work is used a fork-lift truck with a tyre stacker. The tyres are stacked successively in the rows upon each other during the gradually extent of the rows. In this connection there is no need for a long range in front of the fork-lift truck, and thus in respect of the manoeuvrability of the for-lift truck with the tyre stacker, it is preferred that the frame is attached to the pivot able console nearest the first and of the frame by a quick coupling provided with locking means.

Loading tyres from the above mentioned stacks onto loading surfaces or trailers is performed by a sufficient lowering of the gripping plates from above the row of tyres standing on their tread, until the adjustable/displaceable counter holds are brought in touch with the tread of the tyres, with the frame placed in horizontal position, the claw is then activated to bring the gripping plates in attack with the tread to grip the tyres, whereupon they are lifted out of the row in upstanding position by the fork-lift truck. The tyres are then transported locked in the tyre stacker to the load surface/the trailer, and during the transfer the frame is pivoted by the pivotal console by aid of the first actuators to a vertical orientation, and the tyres are then arranged on the load surface in a pile lying on the side. In connection with loading the tyres it will be advantageous to be able to perform this work, loading the load surface/the trailer from one side. This makes it impossible to reach the distant parts of the load surface with the tyre stacker. With the purpose to enable loading of a load surface or a trailer with tyres only from one side, a spatial element may be located between the lifting base of the fork-lift truck and the hydraulic pivot able console.

It is hereby achieved that the tyre stacker is located in a distance from the fork-lift truck to enable the tyre stacker to reach over the load surface/ the trailer, and thus being able to reach the whole load surface loading only from the one side.

However, using the spatial element together with the tyre stacker results in a considerable increase of the load of momentum on the fork-lift truck, and further the necessary operating area for the for-lift truck will also be increased considerable. With the purpose to decrease the momentum load on the fork-lift truck related to the use of the tyre stacker, and further to reduce the necessary operating area, the frame may be attached to the pivot able console close to the middle of the frame by a quick connection provided with locking means.
Hereby is achieved a considerable reduce of the load of momentum on the fork-lift truck, since the distance between the front point of the tyre stacker and the lifting base of the fork-lift truck is reduced with approximately half the length of the frame, without reducing the increased reach-ability achieved using the spatial element. Further, the load of momentum on the pivotal console is reduced, and accordingly the consumption of energy is reduced pivoting a stack of tyres from a horizontal orientation of the frame to a vertical orientation of the frame.

In the purpose of securing an ideal operation with the tyre stacker according to the invention, it is important that the displacement of the jaws is predictable during the operation, it is therefore preferred that the tyre stacker comprises means securing that a relative displacement between the first and the second cooperating gripping jaw towards and away from each other, substantially takes place synchronically.

Hereby the cooperating jaws will be displaced equally in the preferred direction during operation.

The first preferred manner to secure a synchronous displacement of the gripping jaws might advantageously consist of a control unit controlling the second actuators to perform an identical displacement.

The control unit might consist of a regulation valve, which in case the actuators consist of hydraulic driven pistons, secures the supply of the same amount of oil under pressure to the second hydraulic pistons.

Another preferred way to secure a synchronous displacement of the cooperating gripping jaws might comprise a mutual cooperating toothing on the first against each other curved organs, rested in second pivot bearings on each side of the frame.

Since the location of the displaceable counter holds in the cavity between the cooperating gripping jaws is crucial, it is important that they are located in a well defined position. It will therefore be of great importance that the relative displacement between the displaceable counter holds will take place uniformly, and thus, the hydraulic tyre stacker might advantageously comprise means securing that a mutual relative displacement between the displaceable counter holds on the sec-
ond organs takes place as a synchronous or a substantially synchronous relative displacement.

The means to ensure the synchronous movement of the displaceable counter holds during relative displacement can consist of a control unit controlling the third actuators. Again, the control unit might consist of a regulation valve, which in case the actuators consist of hydraulic driven pistons, secures the supply of the same amount of oil under pressure to the third hydraulic pistons.

With the purpose to ensure the gripping plates to achieve a suitable firm grip on the treads of the tyres, the adjacent side surfaces of the gripping plates might completely or partially comprise an antiskid surface/coating, completely or partially covering said side surfaces.

It is hereby achieved an enhanced grip on the frequently very smooth treads of the tyres during the handling procedure using the tyre stacker.

With the purpose to be able to compensate for that the piles of tyres to be handled by the tyre stacker, is not always strictly vertical orientated, or when the tyres are not arranged in straight lines, when they are arranged in rows, standing on the treads, the gripping plates advantageously can be pivotally rested in resilient bearings comprising adjustable stops to limit the pivotal movement of the gripping plates.

It is hereby achieved when picking up tyres with the cooperating gripping jaws, the gripping jaws will be able to compensate somewhat for obliqueness when being introduced to tyres stacked in piles or arranged in rows, further the operator operating with the tyre stacker does not necessarily need to spend time manoeuvring the tyre stacker to a completely correct picking up position. Hereby is saved time during the handling procedure with the tyres.

The invention will be further disclosed in the following referring to the accompanied drawings, where

Fig. 1 is a perspective view of a fork lift truck seen from the front side with a first embodiment of a tyre stacker according to the invention with the frame in horizontal position,
Fig. 2 shows the same as Fig. 1, where the frame is performing a pivotal movement to vertical orientation,

Fig. 3 shows the same as Fig. 1, now with the frame pivoted to vertical position, and lifted over the ground,

Fig. 4 shows the same as Fig. 3, where the frame is lowered to abut the ground,

Fig. 5 shows a perspective view from above of a fork lift truck with a second embodiment of a tyre stacker according to the invention,

Fig. 6 shows the same as Fig. 5, but as cross section through the tyre stacker, showing the second actuators,

Fig. 7 shows the same as Fig. 5, but as cross section though the tyre stacker, showing the third actuators, and

Fig. 8 shows the same as Fig. 5, where a spatial element attached to the middle of the frame of tyre stacker, is placed between the lifting base of the fork lift truck and the pivotal console.

Fig. 1 is a perspective view of a fork lift truck 2, with a first embodiment of a tyre stacker 4 mounted by an A-frame 8 on the lifting base 6 of the fork lift truck. The A-frame 8 comprises a console 10 for a pivot device 11 comprising hydraulic driven cylinders 12 and pistons the free ends of which by pivot connections 14 are connected with the first end 16 of a rectangular frame 18 of the tyre stacker 4, said frame 18 being attached to the pivot device 11 by further pivot connections 20.

The rectangular frame 18 comprises a first long side 22 and a second long side 24 on which respectively is rested a first gripping jaw 26 and a second cooperating gripping jaw 28. Each gripping jaw 26, 28 comprises first towards each other crumbing pivotal organs 32 rested in pivot bearings 30. In the free ends of the organs is mounted a gripping plate 34 which is orientated parallel with the frame 18. The gripping plates 34 are relatively displaceable against and away from each other by a second set of actuators 36 connected with pivot connections respectively to the frame 18 and the first organs 32. In the shown embodiment a number of stops 44 are located on the adjacent side 42 of the frame 18 orientated in the direction of the gripping plates 34.

The characteristic feature related to this embodiment of the tyre stacker 4 is that there on the organs 32 on each gripping jaw 26, 28 is rested second organs 46, which by third pivot bearings 48 are pivotal connected to the first organs 32. The second organs 46 are by a third set of actuators 50 displaceable against each
other out from the first organs 32 between the gripping plates 34 and the pivot bearings 30 of the first organs 32 into the cavity 52 defined by the first crumbing organs 32 and the gripping plates 34 in common. The free ends 54 of the second organs 46 are mutual connected by a stop beam 56 orientated parallel with the gripping plates 34 and the frame 18.

As it appears from fig. 1, fig. 2, fig. 3 and fig. 4 the tyre stacker 4 in the shown embodiment is used by bringing the stop beams 56 in the preferred position in the cavity 52 between the first and the second gripping jaw 26, 28 by activating the third actuators 50. The tyre stacker 4 is then by the fork lift truck lowered down over a row of tyres or a tyre standing on their treads cf. fig. 1 until the stop beams 56 are in abutment with upward facing part of the tyre 58, the gripping jaws are then displaced towards each other for engagement on the opposite sides of the tyre 58 near the middle of the tyre, preferably a bit before the middle, by activating the second actuators 36. The tyre stacker 4 is then lifted by displacing the lifting base 6 of the fork lift truck, at the same time the first actuators 12 of the tyre stacker are activated pivoting the frame from horizontal to vertical orientation cf. fig. 2 and fig. 3, and the tyres are then transported to the loading area, where the tyres 58 are placed at the desired location, by displacing the gripping jaws 26, 28 away from each other by activating the second actuators 36. It shall be stated that the tyre stacker 4 in the shown embodiment also is able to perform the tyres placed upstanding on their treads 60, cf. fig. 2.

It shall be mentioned that the displacement of the first- and the second gripping jaw 26, 28 takes place synchronous by the second actuators 36, which consists of hydraulic driven pistons, where the supply of oil to the respective cylinders is controlled by a regulation unit (not shown). In the same manner is the synchronous displacement of the third actuators which also consists of hydraulic driven pistons, controlled by a further not shown regulation unit.

In fig. 5, fig. 6 fig. 7 and fig. 8 is shown a further embodiment of the tyre stacker 4 according to the invention, basically constructed as the tyre stacker 4 specified above, and comprising similar functions as mentioned in the above.

The difference from the embodiment of the tyre stacker 4 shown in fig. 1 is that the synchronous movement of the first and the second gripping jaw 26, 28 here is established by the first against each other crumbing organs 32 are attached on shafts 62, 64 pivotally attached to the short sides 66, 68 of the rectan-
gular frame 18, cf. fig. 5 and fig. 6, and that the organs 32 near their attachments on the shafts 62, 64 comprises mutual cooperating toothings (70) cf. fig. 6, which results in that activating the second actuators 36, which also here consists of hydraulic driven pistons, will cause the organs 32 and following also the gripping jaws 26, 28 will be displaced synchronous. The second actuators 36 are in this embodiment located on attachments 72, 74 protruding away from the opening 52 between the gripping jaws 26, 28.

From fig. 7 it further appears that the stop beams 56 are attached on the second organs 46, which in this embodiment are attached to the pivotal supported shafts 62, 64, and the third actuators 50, which also here consists of hydraulic driven pistons, are by pivot connections 76, 78 connected to respectively the stop beams 56, and suitable protruding attachments 80, 82 on the organs 32. The synchronous displacement of the stop beams 56 are provided by a non shown regulation unit which secures an equivalent displacement of the third actuators 50.

In fig. 8 is shown the tyre stacker 4 disclosed in fig. 6 - fig. 8 mounted on a spacing piece 84 between the lifting base 6 of the fork lift truck and the pivotal console 11 which is connected with the frame 18 by a pivot connection 16, which in the shown embodiment of the tyre stacker 4 is located at the middle of the frame 18. The advantage is that the momentum force on the frame and the lifting base 6 of the fork lift truck will be reduced during operations with the tyre stacker. The presence of the spacing piece 84 results in, that a pile of tyres 58 can be placed on the most distant areas of a loading area, from the one side of a trailer or a loading surface on a lorry on which the tyres are placed for further transport.

The connections between the pivotal console 11 and the frame 18 of the tyre stacker might advantageously consist of quick connections (not shown) of the kind used on shovels on hydraulic excavators, ditch excavators etc., however provided with a locking unit, preventing unauthorised/unintended separation between the console and the frame.
Position numbers:

2  fork lift truck  
4  tyre stacker  
5  6  lifting base on 2  
8  A-frame  
10  console for pivot device  
11  pivot device  
12  hydraulic cylinders  
14  pivot connection, connected to the first end 16 of pos. 18  
16  first end of the frame 18  
18  rectangular frame  
20  pivot connections  
22  first long side of 18  
24  second long side of 18  
26  first gripping jaw  
28  second gripping jaw  
30  pivot connection for 32  
32  against each other crumbing first organs  
34  gripping plate  
36  second set of actuators for 26 and 28  
38  pivot connections between 36 and 38  
40  pivot connections between 32 and 18  
42  the against 34 facing side of 18  
44  stop  
46  the second organs attached on 32  
48  third pivot connections between 32 and 46  
50  third set of actuators  
52  cavity defined by 32 and 34 in common  
54  free ends of 46  
56  stop beams on 46  
58  tyres  
60  tread on 58  
62  shaft anchored in 66, 68  
64  shaft anchored in 66, 68  
66  short side of 18  
68  short side of 18  
70  toothing on 32
72 attachment for 36
74 attachment for 36
76 pivot connection
78 pivot connection
80 portion on 32 for 50
82 portion on 32 for 50
84 spacing piece between the pivotal console 11 and the lifting base 6
CLAIMS

1. Hydraulic tyre stacker (4) for mounting on a fork-lift truck (2), and comprising a releasable attached frame (18) for mounting on a lifting base (6) on a fork lift truck, said frame (18) comprising a first end (66) and a second end (68), which is pivotal by a pivot able releasable attached console (11) on the lifting base (6) comprising first pivotal connections (20) and first set of actuators (12), the first and second side (22, 24) of said frame respectively comprising a first- and a second cooperating gripping jaw (26, 28), said gripping jaws (26, 28) being symmetrical and laterally reversed, each comprising a continuous, unbroken, front gripping plate (34) arranged parallel with the frame (18), said gripping plates (34) being located in the free ends of at least two first curved organs (32), said organs (32) being pivotally connected to the frame (18) by second pivotal connections (30), said gripping plates (34) being relatively displaceable towards- and away from each other by a second set of actuators (36), and where said pivotally organs comprises a number of counter holds (44), located between the pivotal connections (30) and the gripping plates (34), and/or on the side (42) of the frame adjacent to the gripping plates, the length of said counter holds (44) being substantially equal to the length of the gripping plates, characterized in that at least one of the counter holds (44) on each of the gripping jaws is located on second organs (46), said second organs being pivotal by third pivotal connections (48), and displaceable towards each other by a third set of actuators (50), away from the first organs (32) between the gripping plate (34) and the pivotal connections (30) of the first organs (32), into the cavity defined by the first curved organs (32) and the gripping plates (34) in common.

2. Hydraulic tyre stacker (4) according to claim 1, characterized in that the frame (18) is connected to the pivotal console (11) close to the first end of the frame by a quick connection provided with locking means.

3. Hydraulic tyre stacker (4) according to claim 2, characterized in that a spacing unit (84) is located between the lifting base (6) and the hydraulic pivotal console (11).

4. Hydraulic tyre stacker (4) according to claim 3, characterized in that the frame (18) is connected to the pivotal console (11) near the middle of the frame with a quick connection provided with locking means.
5. Hydraulic tyre stacker (4) according to any of the preceding claims 1-4, characterised in that it comprises means for securing a substantially synchronous relative displacement between the first and the second cooperating gripping jaw (26, 28) towards and away from each other.

6. Hydraulic tyre stacker (4) according to claim 5, characterised in that the means for securing a synchronous displacement of the cooperating gripping jaws (26, 28) is comprised by a control unit controlling the second actuators (36).

7. Hydraulic tyre stacker (4) according to claim 5, characterised in that the means for securing a synchronous relative displacement between the first and the second cooperating gripping jaw (26, 28) is comprised by a mutual cooperating toothing (70) on the first against each other curved organs (32) pivotally attached to the frame (70).

8. Hydraulic tyre stacker (4) according to any of the claims 1-4, characterised in that it comprises means securing a synchronous or approximately synchronous relative displacement between the displaceable counter holds (56).

9. Hydraulic tyre stacker (4) according to claim 8, characterised in that the means securing a synchronous relative displacement between the displaceable counter holds (56) is comprised by a control unit controlling the third actuators.

10. Hydraulic tyre stacker (4) according to any of the claims 1-9, characterised in that the adjacent side surfaces (86) of gripping plates (34) completely or partially comprises an antiskid surface/coating, completely or partially covering said side surfaces.

11. Hydraulic tyre stacker (4) according to any of the claims 1-9, characterised in that the gripping plates (34) are pivot able in resilient bearings with adjustable end stops for limiting the pivotal movement of the gripping plates (34).
INTERNATIONAL SEARCH REPORT

A CLASSIFICATION OF SUBJECT MATTER

B66F 9/18 (2006.01); B66C 1/62 (2006.01); B66C 3/16 (2006.01)
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)
B66F, B66C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
DK, SE, FI, NO, B66F 9/12, 9/18

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

EPDOC, WPI

C DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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D Further documents are listed in the continuation of Box C

*   Special category of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search
29.05.2009

Date of mailing of the international search report
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