RING LOCK AND METHOD FOR MANUFACTURING A RING LOCK

A ring lock (1) provided with a lock housing with a lock assembly included therein and a bolt (11). Further, the ring lock (1) includes a front lock cap (2) with two front lock cap legs (4A) which are connected with a front lock cap body (5A) and a rear lock cap (3) with two rear lock cap legs (4B) which are connected with a rear lock cap body (5B). In a mounted condition the lock housing and the bolt (11) are at least partly included between the front lock cap (2) and the rear lock cap (3), the front lock cap (2) and the rear lock cap (3) being connected with each other at contact surfaces by at least one capacitor discharge weld connection. Also described is a method for manufacturing such a lock.

Fig. 5
The invention relates to a ring lock which can be applied to a cycle, such as a bicycle, an electric bicycle, a moped, a go-cart, or like vehicles.

A ring lock with a welded connection is known from inter alia the publications DE25 19 068, NL 1.021.598 and EP 1.834.864.

DE25 19 068 discloses a bicycle lock, more particularly ring lock, comprising:
- a lock housing with a lock assembly included therein;
- a bolt;
- a front lock cap with two front lock cap legs which are connected with a front lock cap body;
- a rear lock cap with two rear lock cap legs which are connected with a rear lock cap body;

wherein in a mounted condition the lock housing and the bolt are at least partly included between the front lock cap and the rear lock cap and wherein the front lock cap and the rear lock cap are connected with each other by a weld connection.

The front lock cap legs, the rear lock cap legs, the front lock cap body and the rear lock cap body are provided with outwardly directed circumferential flanges which are configured to adjoin each other and to be welded together by spot welding.

The disadvantage of these prior art ring locks is that they are manufactured with a traditional spot welding technique. This spot welding technique leads to a substantial heat generation in the lock and may thereby lead to damage of parts included between the front lock cap and the rear lock cap. The lock caps themselves too may be damaged by the known spot welding process, so that, for instance, a protective coating, such as, for example, a zinc coating, is damaged and an extra processing operation for applying a protective coating after the welding process is necessary.

In spot welding, the spot (weld) that is welded mostly has a diameter of 4 to 5 times the plate thickness. The spot welds are mutually spaced apart and between the spot welds the front and rear caps are not connected with each other. This creates the possibility of applying a breaking tool between the spot welds in order to break the lock open. Moreover, spot welds are not provided in one go but in a number of welding operations. Only one or two spots at a time can be welded per welding operation. Providing the spot welds is therefore time consuming and hence costly. Also, it is not possible to connect end edges of the steel directly to each other by spot welding.

Another disadvantage of the lock known from DE25 19 068 is constituted by the circumferential flange at the front lock cap body and the rear lock cap body. This circumferential flange, which is necessary to be able to provide the spot welds, takes up considerable space, which limits the assembly possibilities of the lock.

The invention contemplates the provision of a ring lock that features the advantages of the known lock and that solves at least partly the disadvantages thereof. More particularly, the invention contemplates a ring lock with an improved connection between the front lock cap and rear lock cap. To that end, the invention provides a ring lock, comprising:
- a lock housing with a lock assembly included therein;
- a bolt;
- a front lock cap with two front lock cap legs which are connected with a front lock cap body;
- a rear lock cap with two rear lock cap legs which are connected with a rear lock cap body;

wherein in a mounted condition the lock housing and the bolt are at least partly included between the front lock cap and the rear lock cap and wherein the front lock cap and the rear lock cap are connected with each other by a weld connection, characterized in that the weld connection is a capacitor discharge weld connection, the front lock cap and/or the rear lock cap being provided with at least one contact surface by which the front lock cap and the rear lock cap prior to a capacitor discharge weld process abut against each other and at which, following a capacitor discharge weld process, the capacitor discharge weld connection is formed by which the front lock cap and the rear lock cap are connected with each other.

The invention has a number of advantages over DE25 19 068. Firstly, in capacitor discharge welding, less heat is induced than in spot welding, so that the temperature increase of the front lock cap and rear lock cap and of the parts at least partly included therein, is small. In capacitor discharge welding, entire continuous contours can be welded in one go. Differences in material and plate thickness in the various welding areas are much less of influence on the capacitor discharge weld process. With the aid of capacitor discharge welding it is possible to connect the entire circumferential contour of the lock by a capacitor discharge weld connection in one capacitor discharge welding operation. Moreover, it is possible to realize this capacitor discharge weld connection at the front lock cap body and the rear lock cap body without providing a circumferential flange there, in that the end edges of the front lock cap body and the rear lock cap body can be connected with each other directly. As there is no flange necessary at the front lock cap body and the rear lock cap body, the lock can remain reasonably small. Consequently, it fits bicycles and other cycles better, even when the assembly space on them is limited. Realizing such a weld connection extending substantially along the entire circumferential contour is not possible with the aid of conventional welding techniques such as spot welding.

In a further elaboration of the invention, in the ring lock, both at the lock cap legs, formed by the assembly of the front lock cap legs and the rear lock cap legs, and at the lock cap body, formed by the assembly of the
front lock cap body and the rear lock cap body, prior to the capacitor discharge weld process, at least one contact surface as mentioned may be present at which, following the capacitor discharge weld process, a capacitor discharge weld connection is formed.

[0010] Thus, cracking the lock is virtually impossible both at the lock cap legs and at the lock cap body. This is achieved in particular in that the capacitor discharge weld connection can be a continuous connection and not, as with spot welding, a local connection, where in effect there is no connection between the spot welds.

[0011] In a further elaboration of the invention, the rear lock cap and/or the front lock cap may be provided at least one indentation which in a condition of the front lock cap and the rear lock cap placed on each other prior to the capacitor discharge weld process forms a contact surface that is configured as a line contact between the front lock cap and the rear lock cap, wherein in the condition of the front lock cap and the rear lock cap placed on each other the two caps touch each other via the line contacts, and wherein after the capacitor discharge weld process at the line contacts mentioned a capacitor discharge weld connection is formed between the front lock cap and the rear lock cap.

[0012] The further elaboration as has an advantage that the contact surface configured as line contact has a small surface, so that the heat generation thereat is optimal, while the transmitted electric power is relatively small. The amount of heat energy, however, owing to the small contact surface, is relatively small, with the advantage that the conduction of the heat to the contiguous parts of the lock is small. As a result, damage of lock parts or of the front lock cap and/or rear lock cap will not readily occur. Another advantage of a capacitor discharge weld connection formed from the line contact connection is that this creates a continuous connection zone without interruptions. Breaking open such a continuous connection zone is practically impossible.

[0013] In an embodiment of the ring lock, the front lock cap legs and the rear lock cap legs are provided with outer flanges which have an outer flange length that corresponds substantially to a length of the leg associated with a respective outer flange, while an at least one indentation is provided in at least one of two opposite outer flanges such that at the at least one indentation prior to the capacitor discharge weld process a line contact is formed between opposite outer flanges of a front lock cap and a rear lock cap, respectively, and following the capacitor discharge weld process at the line contact mentioned a capacitor discharge weld connection is formed which connects the opposite outer flanges with each other substantially along the entire outer flange length.

[0014] An advantage of this embodiment is that connecting the outer flanges with a capacitor discharge weld along substantially the entire outer flange length contributes to a firm connection between the front lock cap and the rear lock cap at the lock cap legs (which are formed by the front lock cap legs and rear lock cap legs). This is also important towards preventing the lock being broken open at the lock cap legs.

[0015] A further advantage of a robust connection can be achieved by a further embodiment of the invention in which the front lock cap legs and the rear lock cap legs may be provided with inner flanges, while an at least one indentation is provided in at least one of two opposite inner flanges such that at the at least one indentation prior to the capacitor discharge weld process a line contact is formed between opposite inner flanges of a front lock cap and a rear lock cap, respectively, and following the capacitor discharge weld process at the at least one line contact a capacitor discharge weld connection is formed. The firm connection at the inner flanges also contributes to a good basis for connecting the ring lock with, for example, a bicycle which it may be a part of.

[0016] In an embodiment, the front lock cap body and the rear lock cap body may be provided with mutually facing plate end edges which prior to the capacitor discharge weld process form a contact surface, and following the capacitor discharge weld process at the mutually facing plate end edges at least one capacitor discharge weld connection is formed.

[0017] By connecting the front lock cap and the rear lock cap with a capacitor discharge weld connection at the lock cap body, a robust connection is realized which makes breaking open the ring lock at the top more difficult. In contrast to DE 25 19 068, the front lock cap body and the rear lock cap body are not provided with a circumferential flange but the mutually facing plate end edges are connected with each other directly by the capacitor discharge weld connection. Through the absence of these circumferential flanges at the lock cap body, the lock can also be mounted on cycles where the mounting space is relatively limited. Moreover, the end plate end edge connection and the line contact connection at the front lock cap legs and rear lock cap legs can be realized in a single capacitor discharge welding operation - that is, in a single current surge. The production time is therefore particularly short, while the connection between the front lock cap and the rear lock cap is much better resistant to sabotage and breaking.

[0018] In an embodiment, the mutually facing plate end edges can extend substantially along the entire circumference of the front lock cap and the rear lock cap to form the contact surface which, following the capacitor discharge weld process, forms the capacitor discharge weld connection. That is to say, both at the body and at the legs. In such an embodiment, the provision of indentations may be dispensed with. All capacitor discharge weld connections can be formed at mutually facing plate end edges. In such an embodiment, the front lock cap legs and the rear lock cap legs do not need to be provided with outer flanges, which yields a saving of material. Nor are the inner flanges necessary anymore for establishing a connection between the front lock cap and the rear lock cap. Such inner flanges, however, may still be of benefit for the purpose of mounting the ring lock to a cycle.
In order to enable, in addition to capacitor discharge welding, a traditional manner of connection as well, the front lock cap and the rear lock cap may be provided with at least one opening for connecting the front lock cap and rear lock cap by means of rivets.

In an embodiment, the front lock cap and the rear lock cap may each be manufactured by at least one punching operation from plate material extending in a plane plate, whereby in the at least one punching operation there are formed:

- the front lock cap with two front lock cap legs which are connected with the front lock cap body;
- the rear lock cap with two rear lock cap legs which are connected with the rear lock cap body;
- at least one indentation for forming a contact surface between the front lock cap and the rear lock cap; and/or
- at least one plate end edge, extending at right angles to the plate plane to form a contact surface between the front lock cap and the rear lock cap.

The invention also comprises a method for manufacturing a ring lock comprising:

- a lock housing with a lock assembly included therein;
- a bolt;
- a front lock cap with two front lock cap legs which are connected with a front lock cap body; and
- a rear lock cap with two rear lock cap legs which are connected with a rear lock cap body;

wherein the method at least comprises:

- positioning the lock housing such that it is substantially between the front lock cap body and the rear lock cap body,
- positioning the bolt such that it extends through the lock housing and, at least in part, is included between the front lock cap legs and the rear lock cap legs,
- positioning the front lock cap and the rear lock cap such that they adjoin each other by contact surfaces,
- pressing the front lock cap and the rear lock cap against each other, and
- through capacitor discharge welding, welding together the front lock cap and the rear lock cap at the contact surfaces, whereby a short current surge is conducted through the front lock cap and the rear lock cap via the contact surfaces, whose intensity and duration are such that at the contact surfaces the material of the front lock cap and the rear lock cap fuses together and a capacitor discharge weld connection is formed there.

The advantage of this method is that in capacitor discharge welding heat is supplied very locally. As a result, the firmness of a welded connection is realized without the parts included between the front lock cap and rear lock cap, viz., the bolt and the lock housing with lock assembly included therein, sustaining a large increase in temperature. In addition, the very local supply of heat provides the advantage that the on-site heat generation is optimal, at a relatively low transmitted electric power. Moreover, the method according to the invention has the advantage that it is possible to connect the entire outer circumferential contour of the lock with each other substantially along the entire length thereof with a single current surge. This in contrast to the spot welded connections that are made in the lock known from DE 25 19 068.

Such spot welds are provided singly, and between the spot welds the front lock cap and the rear lock cap are not connected with each other, so that with this known lock breaking open the lock by prying a screwdriver between two neighboring spot welds is one of the possibilities.

In an embodiment of the method, the lock cap legs, formed by the front lock cap legs and the rear lock cap legs, as well as the lock cap body, formed by the front lock cap body and the rear lock cap body, may each be provided with at least one contact surface that extends along substantially the entire outer contour of the lock cap legs (4) and along substantially the entire outer contour of the lock cap body (5). Thus, the lock cap, formed by the front lock cap and the rear lock cap, is provided at at least three places, more particularly along substantially the entire outer contour, with a capacitor discharge weld connection which makes breaking open the lock more difficult.

In an embodiment, the contact surfaces may be formed by line contacts and/or mutually facing plate end edges, with a total contact surface of less than 700 mm², preferably less than 500 mm².

By the use of contact surfaces in the form of line contacts or mutually facing plate end edges with a total contact surface of less than 700 mm² and preferably less than 500 mm², a high local heat supply can be attained at a relatively low electric power. In addition, a limited contact surface also leads to a limited temperature increase in the other parts of the lock cap during welding, so that damage of parts in the lock cap is avoided.

In an embodiment, the at least one contact surface may be formed exclusively by mutually facing plate end edges, which extend substantially along the entire circumferential length of the front lock cap and the rear lock cap. Both at the body and at the legs, the contact surface is then formed by mutually facing plate end edges which after the capacitor discharge weld process form the capacitor discharge weld connection. The provision
In an embodiment, providing capacitor discharge weld connections at all contact surfaces is carried out in a single welding operation, that is, with a single current surge.

All connections are therefore established in a single operation, so that a high production capacity can be obtained. In any case, the provision of the connection between the front lock cap and the rear lock cap does not constitute a bottleneck in the production process because it merely comprises placing the two caps on each other, pressing-on, and transmitting a large current surge through the two caps.

In an embodiment, in the front lock cap and/or the rear lock cap at least one indentation may be provided which, in a condition of the front lock cap and rear lock cap placed on each other, forms a contact surface between the front lock cap and the rear lock cap.

During capacitor discharge welding, in an embodiment, the front lock cap and the rear lock cap can be pressed onto each other with a force of at least 80 kN. This force contributes to the bringing about of a good capacitor discharge weld connection.

In an embodiment, during the capacitor discharge welding, no welding material is added. This leads to lower costs and a lower consumption of material. Moreover, no, or hardly any, damage of the front lock cap and the rear lock cap occurs as a result of the capacitor discharge weld process.

In a further elaboration, the surface area of the contact surfaces can be so small that during the capacitor discharge welding the generation of heat in the front lock cap and the rear lock cap occurs only locally and, as a result, the increase of temperature of the bolt and the lock housing with the lock assembly included therein is less than 50 °C and preferably less than 40 °C. By staying below this temperature increase in the method, damage of the lock parts, among which the bolt and the lock housing including lock assembly, is prevented.

Finally, the invention provides a vehicle provided with a ring lock according to any one of claims 1-9. In an embodiment, the vehicle may be selected from the group consisting of: a bicycle, an electric bicycle, a moped, a go-kart and a human powered vehicle, such as a tricycle or a wheelchair.

Fig. 1 is a front view of an example of an embodiment of the ring lock according to the invention prior to the provision of the capacitor discharge weld connections;

Fig. 2 is a rear view of the ring lock represented in Fig. 1;

Fig. 3 is a side view of the ring lock represented on Fig. 1;

Fig. 4 is a top plan view of the ring lock represented in Fig. 1;

Fig. 5 is a cross-sectional view along the line V-V in Fig. 1;

Fig. 6 is a cross-sectional view along the line VI-VI in Fig. 1;

Fig. 7 is a cross-sectional view along the line VII-VII in Fig. 2;

Fig. 8 is a side view of an embodiment of the ring lock of Fig. 1, but now after the provision of the capacitor discharge weld connections;

Fig. 9 is a top plan side view of an embodiment of the ring lock of Fig. 1, but now after the provision of the capacitor discharge weld connections;

Fig. 10 is a cross-sectional view along the line V-V in Fig. 1, but now after the provision of the capacitor discharge weld connections;

Fig. 11 is a cross-sectional view along the line VI-VI in Fig. 1, but now after the provision of the capacitor discharge weld connections;

Fig. 12 is a cross-sectional view along the line VII-VII in Fig. 2, but now after the provision of the capacitor discharge weld connections; and

Fig. 12a is a detailed view of VIIa in Fig. 12.
Fig. 4 is a top plan view of the embodiment of the mutually facing plate end edges 10 between front lock cap body 5a and rear lock cap body 5b. Also visible are the contact surfaces, formed by the indentations 6a in the outer flanges 7 of the rear lock cap 3, at which the front lock cap legs 4a and rear lock cap legs 4b touch each other.

Fig. 5 is a cross-sectional view along the line V-V in Fig. 1 prior to the provision of the capacitor discharge weld connections. The depicted ring lock 1 with a contact surface. An enlargement of the contact surface in detail VIa is given in Fig. 12a.

Fig. 6 is a cross-sectional view along the line VI-VI in Fig. 1, prior to the provision of the capacitor discharge weld connections. Fig. 6 shows the front lock cap body 5a and the rear lock cap body 5b with the mutually facing plate end edges 10 thereat forming a contact surface. An enlargement of the contact surface in detail VIa is given in Fig. 6a. Also represented is the contact surface between the outer flanges 7 of the front lock cap legs 4a and the rear lock cap legs 4b, formed by the indentation 6a, is represented in Fig. 5a.

Fig. 7 is a cross-sectional view along the line VII-VII in Fig. 2. Fig. 7 shows an indentation 6b between the inner flanges 8 of the front lock cap legs 4a and the rear lock cap legs 4b. An enlargement of the indentation 6b in detail VIIa is represented in Fig. 7a.

Figs. 8-12a show an embodiment of the ring lock after the provision of the capacitor discharge weld connections. Fig. 8 is a side view of the embodiment of the ring lock 1 after the provision of the capacitor discharge weld connections. The front lock cap body 2 and rear lock cap body 3 are connected at the plate end edges 10 with a capacitor discharge weld connection, and the outer flanges 7 are mutually connected along an entire outer flange length of the outer flanges 7 through a capacitor discharge weld connection.

Fig. 9 is a top plan view of the embodiment of the ring lock after provision of the capacitor discharge weld connections. There are shown the front lock cap body 5a and the rear lock cap body at the plate end edges 10, which form a contact surface and are connected there by a capacitor discharge weld connection. Also visible are the line contacts between the outer flanges 7 of the front lock cap legs 4a and the rear lock cap legs 4b, which are connected with a capacitor discharge weld connection along the entire outer flange length.
3. The ring lock (1) according to any one of the preceding claims, wherein the rear lock cap (3) and/or the front lock cap (2) is provided with at least one indentation (6) which in a condition of the front lock cap (2) and the rear lock cap (3) is arranged in at least one of two opposite inner flanges (8) such that at the at least one indentation prior to the capacitor discharge weld process a line contact is formed between opposite outer flanges of a front lock cap (2) and a rear lock cap (3), respectively, and wherein the capacitor discharge weld process at said line contact a capacitor discharge weld connection is formed which connects the opposite outer flanges (7) with each other substantially along the entire outer flange length.

4. The ring lock (1) according to any one of the preceding claims, wherein the front lock cap legs (4a) and the rear lock cap legs (4b) are provided with outer flanges (7) which have an outer flange length that corresponds substantially to a length of the leg (4a, 4b) associated with a respective outer flange (7), wherein an at least one indentation (6a) is arranged in at least one of two opposite outer flanges (7) such that at the at least one indentation prior to the capacitor discharge weld process a line contact is formed between opposite outer flanges of a front lock cap (2) and a rear lock cap (3), respectively, and wherein the capacitor discharge weld process at said line contact a capacitor discharge weld connection is formed.

5. The ring lock (1) according to any one of the preceding claims, wherein the front lock cap body (5a) and the rear lock cap body (5b) are provided with inner flanges (8), wherein an at least one indentation (6b) is arranged in at least one of two opposite inner flanges (8) such that at the at least one indentation prior to the capacitor discharge weld process a line contact is formed between opposite inner flanges (8) of a front lock cap (2) and a rear lock cap (3), respectively, and wherein the capacitor discharge weld process at said one line contact a capacitor discharge weld connection is formed.

6. The ring lock (1) according to any one of the preceding claims, wherein the front lock cap body (5a) and the rear lock cap body (5b) are provided with mutually facing plate end edges (10) which prior to the capacitor discharge weld process form a contact surface, and wherein the capacitor discharge weld process at said mutually facing plate end edges (10) at least one capacitor discharge weld connection is formed.

7. The ring lock (1) according to claim 6, wherein said mutually facing plate end edges (10) extend substantially along the entire circumference of the front lock cap (2) and the rear lock cap (3) to form the contact surface, which following the capacitor discharge weld process forms the capacitor discharge weld connection.

8. The ring lock (1) according to any one of the preceding claims, wherein the front lock cap (2) and the rear lock cap (3) are provided with at least one opening
(9) for connecting said front lock cap (2) and rear lock cap (3) by means of rivets.

9. The ring lock (1) according to any one of the preceding claims, wherein the front lock cap (2) and the rear lock cap (3) are each manufactured by at least one punching operation from plate material extending in a plate plane, wherein in the at least one punching operation there are formed:

- a front lock cap (2) with two front lock cap legs (4a) which are connected with a front lock cap body (5a);
- a rear lock cap (3) with two rear lock cap legs (4b) which are connected with a rear lock cap body (5b);
- at least one indentation (6) for forming a contact surface between the front lock cap (2) and the rear lock cap (3); and
- at least one plate end edge (10), extending at right angles to the plate plane to form a contact surface between the front lock cap (2) and the rear lock cap (3).

10. A method for manufacturing a ring lock (1) comprising:

- a lock housing with a lock assembly included therein;
- a bolt (11);
- a front lock cap (2) with two front lock cap legs (4a) which are connected with a front lock cap body (5a); and
- a rear lock cap (3) with two rear lock cap legs (4b) which are connected with a rear lock cap body (5b);

wherein the method at least comprises:

- positioning the lock housing such that it is substantially between the front lock cap body (5a) and the rear lock cap body (5b),
- positioning the bolt (11) such that it extends through the lock housing and, at least in part, is included between the front lock cap legs (4a) and the rear lock cap legs (4b),
- positioning the front lock cap (2) and the rear lock cap (3) such that they abut against each other by contact surfaces,
- pressing the front lock cap (2) and the rear lock cap (3) against each other, and
- through capacitor discharge welding, welding together the front lock cap (2) and the rear lock cap (3) at the contact surfaces, whereby for a short length of time an electric current is conducted through the front lock cap and the rear lock cap via the contact surfaces, the length of time and the magnitude of the current and the voltage being such that at the contact surfaces the material of the front lock cap and the rear lock cap fuses together and a capacitor discharge weld connection is formed there.

11. The method according to claim 10, wherein the lock cap legs (4), formed by the front lock cap legs (4a) and the rear lock cap legs (4b), as well as the lock cap body (5), formed by the front lock cap body (5a) and the rear lock cap body (5b), are each provided with at least one contact surface that extends along substantially the entire outer contour of the lock cap legs (4) and along substantially the entire outer contour of the lock cap body (5).

12. The method according to claim 10 or 11, wherein the contact surfaces are formed by line contacts and/or mutually facing plate end edges (10), with a total contact surface of less than 700 mm² and preferably less than 500 mm².

13. The method according to claim 12, wherein the at least one contact surface is exclusively formed by mutually facing plate end edges (10), which extend substantially along the entire circumferential length of the front lock cap (5a) and the rear lock cap (5b).

14. The method according to any one of claims 10-13, wherein providing the capacitor discharge weld connections at all contact surfaces is carried out in a single welding operation.

15. The method according to any one of claims 10-14, wherein in the front lock cap (2) and/or the rear lock cap (3) at least one indentation (6) is provided which in a condition of the front lock cap (2) and rear lock cap (3) placed on each other forms a contact surface between the front lock cap (2) and the rear lock cap (3).

16. The method according to any one of claims 10-15, wherein during the capacitor discharge welding the front lock cap (2) and the rear lock cap (3) are pressed onto each other with a force of at least 80 kN.

17. The method according to any one of claims 10-16, wherein during the capacitor discharge welding no welding material is added.

18. The method according to any one of claims 10-17, wherein the surface of the contact surfaces is so small that during the capacitor discharge welding the generation of heat in the front lock cap (2) and the rear lock cap (3) occurs only locally and, as a result, the increase of temperature of the bolt (11) and the lock housing with the lock assembly included therein is less than 50 °C and preferably less than 40 °C.
19. A vehicle provided with a ring lock according to any one of claims 1-9.

20. The vehicle according to claim 19, wherein the vehicle is selected from the group consisting of: a bicycle, an electric bicycle, a moped, a go-kart and a human powered vehicle, such as a tricycle or a wheelchair.
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document with indication, where appropriate, of relevant passages</th>
<th>Relevant to claim</th>
<th>CLASSIFICATION OF THE APPLICATION (IPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NL 8 303 428 A (WINKHAUS FA AUGUST) 1 May 1984 (1984-05-01) * Page 11, Line 4 - 7; figures 1 - 19 *</td>
<td>1-20</td>
<td>B62H</td>
</tr>
<tr>
<td>A</td>
<td>DE 33 08 977 A1 (WINKHAUS FA AUGUST [DE]) 19 April 1984 (1984-04-19) * figures 1 - 16 *</td>
<td>1,10,19</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>EP 1 686 049 A1 (STENMAN HOLLAND NV [NL] AXA STENMAN NEDERLAND B V [NL]) 2 August 2006 (2006-08-02) * paragraph [0019]; figures 1 - 3 *</td>
<td>1,10,19</td>
<td></td>
</tr>
</tbody>
</table>

The present search report has been drawn up for all claims.
This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on 17-11-2015

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DK 190176 A</td>
<td>30-10-1976</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE 7604768 A</td>
<td>30-10-1976</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NL 8001496 A</td>
<td>16-09-1981</td>
</tr>
<tr>
<td>US 5802889 A</td>
<td>08-09-1998</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>EP 1834864 A1</td>
<td>19-09-2007</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>NL 8303428 A</td>
<td>01-05-1984</td>
<td>DK 473883 A</td>
<td>15-04-1984</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NL 8303428 A</td>
<td>01-05-1984</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE 456330 B</td>
<td>26-09-1988</td>
</tr>
<tr>
<td>DE 3308977 A1</td>
<td>19-04-1984</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 59206816 D1</td>
<td>29-08-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DK 0550795 T3</td>
<td>25-11-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 0550795 A1</td>
<td>14-07-1993</td>
</tr>
<tr>
<td>EP 1686049 A1</td>
<td>02-08-2006</td>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>

For more details about this annex, see Official Journal of the European Patent Office, No. 12/82
REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader’s convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 2519068 [0002] [0003] [0006] [0008] [0017] [0023]
- NL 1021598 [0002]