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- (72) **Inventor; and**
- (71) **Applicant :** JUSSILA, Veli-Matti Ilari [FI/FI]; Ruodasjärventie 70, FI-37560 LEMPÄÄLÄ (FI).
- (74) **Agent:** NIEMINEN, Taisto; Patenttitoimisto T Nieminen Oy, P.O. Box 65, FI-33201 TAMPERE, FINLAND (FI).
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**Published:**

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) **Title:** A DEVICE FOR LIFTING AND LOWERING

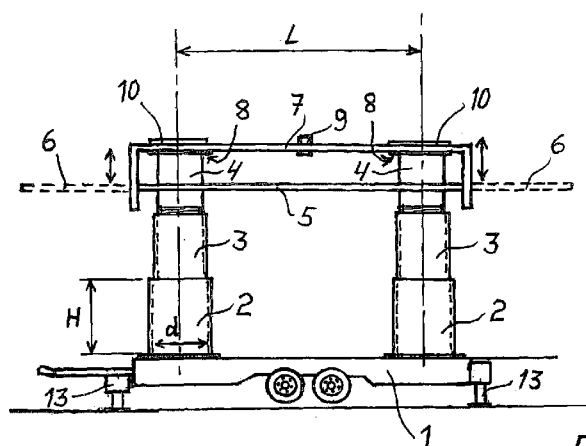


Fig. 1

(57) **Abstract:** Lifting/lowering apparatus, such as a plane that can be lifted, a table or a lifting platform construction, equipped with at least two adjacent lifting mechanisms that can be extended telescopically which lifting/lowering apparatus comprises a lower frame (1), further a horizontal upper frame (7) supported by which a plane, such as a working plane (5), (6) is adjusted and comprises a lifting mechanism adjusted between the mentioned lower frame and upper frame with the help of which lifting mechanism the upper frame (7) can be lifted and lowered in relation to the lower frame (1) and that the lifting mechanism comprises adjacent pillars (2, 3, 4) in which case each pillar is formed of cylinder parts (2 - 4) that can be moved telescopically in relation to each other which cylinder parts are attached to each other with the help of threads in such a way that the rotation of the parts (2 - 4) in relation to each other changes the height of the mentioned pillars. In order to reduce the construction weight the cylinder parts (2 - 4) are made of plastic and in order to improve the receiving of the sideway loadings the inner diameter of the cylinder part (4) having the smallest diameter is over 200 mm.

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## A DEVICE FOR LIFTING AND LOWERING

The invention relates to a lifting/lowering apparatus, such as to a plane that can be lifted,  
5 a table or a lifting platform construction, equipped with at least two adjacent lifting  
mechanism that can be extended telescopically which lifting/lowering apparatus  
comprises a lower frame, further a horizontal upper frame supported by which a plane,  
such as a working plane is adjusted and comprises a lifting mechanism adjusted between  
10 the mentioned lower frame and upper frame with the help of which lifting mechanism the  
upper frame can be lifted and lowered in relation to the lower frame and that the lifting  
mechanism comprises adjacent pillars in which case each pillar is formed of cylinder  
parts that can be moved telescopically in relation to each other which cylinder parts are  
attached to each other with the help of threads in such a way that the rotation of the parts  
in relation to each other changes the height of the mentioned pillars.

15

Previously for example lifting platform constructions are known as lifting/lowering  
apparatuses in which lifting platform constructions a vertical mast is adjusted on top of  
the base. The lifting platform is being moved supported by the mast at the side of the  
mast up and down. The mast can additionally be supported at its upper end to the  
20 building next to which it is installed. The removal of this kind of lifting platform next to  
the building to another location is difficult because the supports of the mast must be  
opened. Often also because of the blocks at the removal line the mast must be  
dismantled, too.

25 Further lifting platforms, so called articulated platforms attached on top of the base are  
known which articulated platforms have a lifting apparatus consisting of articulated arms  
having a articulated form. The disadvantage of these is a fairly high starting height of the  
platform, or the lowest position that is usually about 2 metres regarding such articulated  
platforms with which one can reach the height of 8 – 10 metres. The disadvantage of the  
30 articulated platforms is also the weight of the articulated mechanism which weight lifts  
the centre of gravity of the construction fairly high when the platform is being lifted in  
which case the loading of the platform must be focused mainly only to its centre line.

Also working platforms that can be moved supported by the lifting booms are known in

which case these working platforms are relatively small lifting cages that can be loaded lightly, for example they are meant only for two persons. The advantage of these compared to the other platforms is the greater moving distance in all sideways, but the  
5 disadvantage is the small size of the lifting cage and limited loading capacity and the space required at each time by the lifting booms in sideways and which space is needed in several sideways, too.

Previously a lifting platform construction according to the above mentioned preamble is  
10 known also from a Chinese publication CN 2809309Y. In this construction the telescopic parts are made of metal and they are considerably heavy. In order to avoid the excessive increase of the weight, the telescopic parts have diameters that are as small as possible. Due to this the individual pillar or even two parallel pillars consisting of them cannot handle the sideway forces directed to the upper frame at least at their uppermost position.

15

With the help of a lifting/lowering apparatus according to the invention unexpected improvements can be achieved to the existing prior art and it is characteristic of the invention that in order to reduce the construction weight the cylinder parts are made of plastic and in order to improve the receiving of the sideway loadings, the inner diameter  
20 of the cylinder part having the smallest diameter is over 200 mm.

The advantage of the invention is the fact that the lifting mechanism will need a little space, will be light and will resist the weather. In addition to the lifting mechanism no other constructions conveying power are needed between the lower frame and the upper  
25 frame. With the help of the sizing of the cylinder parts belonging to the lifting mechanism, cylinders in question can be made to receive all the vertical and sideway loadings in question. The lifting mechanism includes only simple parts and the rotating of them. If for example a working platform is being lifted with the lifting mechanism, the platform can easily be made to have a length of several metres, at least over 6 m and to  
30 have a width of over 2 m.

In the following the invention is described more detailed by referring to the accompanying drawings in which

Figure 1 shows a lifting/lowering apparatus according to the invention as a side view.

Figure 2 shows the upper frame of the construction seen from above.

Figure 3 shows the construction seen from the end.

5

In the figure 1 a lifting platform unit built on top of a towed base 1 equipped with wheels supported by pillars 2, 3, 4 made of plastic material and can be extended telescopically and that are located at a distance L from each other is shown as an example. The upper frame 7 of the lifting platform is supported only by the pillars. The parts 2 – 4 of the pillars are attached to each other with a thread and one implementation form is such that the inner part of each part 2 and 3 is completely full of threads and the outer surface of each part 3 and 4 has threads at least at the lower part. When the lowest parts 2 are attached to the base 1 in a non rotating way, only parts 3 and 4 will be rotated during the lifting and lowering of the upper frame 7. Each thread part has preferably the same pitch per a cycle. The uppermost rotating part 4 is also a cylinder made of plastic and has an inner diameter that is over 250 mm. With this diameter dimensioning it is ensured that the wall thickness of the cylinder parts 2 – 4 stays moderate, for example under 30 mm and that the cylinder parts 2 – 4 also resist the side forces directed to them. The ratio of the inner diameter d of the cylinder parts 2 – 4 to the height H is most advantageously between  $1/2 - 1/4$ . Lightness can be reached with the help of plastic materials used as base material of the cylinder parts 2 – 4, the density of which plastic materials is 1,4 kg/dm<sup>3</sup> or under it. The base 1 of the lifting platform is supported by adjustable feet 13 known as such.

25 Parts 3 and 4 are rotated with the help of a rotating motor 9 located at the upper frame 7. There is a flange at the upper edge of the parts 4. The upper frame 7 rests supported by this flange equipped with bearings in such a way that the part 4 and the flange of its upper part can rotate between the counter-flanges belonging to the upper frame 7. The working platform 5 is advantageously adjusted separately at the both sides of the unit.

30 These platforms 5 can be lifted and lowered in relation to the upper frame 7 with the help of their own lifting motors. It is advantageous for this construction that when the upper frame 7 is lowered to its lowest position, the working platform 5 can be lowered with the help of the lifting apparatuses 16 located at the sides even till the ground surface for loading.

In the figure 2 the upper frame 7 is shown from above in such a way that the drawing of the rotating motor 9 with the help of belts 11 and 12 moves to both parts 4 through the band pulleys 14. The flanges 10 are the upper, non rotating flanges belonging to the bearing. The rotating is performed only at the uppermost parts 4. Also the part 3 starts to rotate either with the part 4 or the part 4 rotates by itself. There are tools 15, 16 at the corners of the upper frame 7 in order to attach the working platform 5 to the sides of the upper frame 7 and in order to move it in vertical direction in relation to the upper frame 7.

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In the figure 3 there is a lifting platform construction seen from the end in such a way that the parts 2 and 3 are cut in vertical direction. In the parts 1 and 2 there are threads at the whole inner surface. The part 4 has threads only at the outer surface at its lower part covering the height h. Similarly the part 3 has threads at the outer surface only covering the height h. The rotating of the parts 3 and 4 out of the previous part is prevented for example with the finishing of the inner thread part before the edge border of the part. The rotating of the parts 4 can immediately be conveyed to rotate also the parts 3 till the prevention of the rotation for the part 3 occurs or the parts 4 that rotate first, rotate their whole movement distance and then they start to rotate the part 3. Most advantageously all parts 2 – 4 have the same pitch of the thread per the same cycle. The threads are easy to manufacture into parts 2 – 4 when plastic, such as nylon is used as the material of the parts. Trapeze is the most advantageous form of threads.

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Working platforms that can be moved in vertical direction are arranged downwards from the upper frame 7 at both sides. These platforms are not shown but they are attached to the parts 15 with a some kind of quick attachment method in which case working planes of various lengths and widths can easily be changed to them, if needed. Attaching parts 15 can be moved with the help of the lifting arrangement 16 that comprises motors 18 and conveyor screws 17. When the lifting mechanism of the upper frame 7 is a telescopic pillar solution according to the invention, it is possible to easily arrange the described arrangements of the working platforms at the both sides of the pillars.

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Although a lifting platform construction realized with the help of two pillars is shown in the figures, it is possible to increase the number of the pillars even to four pieces in

which case their diameters can be reduced and in spite of that more stability can be gained. Also the number of the parts 2, 3, 4 is not restricted to three but in the solutions according to the invention there can be more of them.

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Although a lifting platform construction functioning with the lifting/lowering apparatus according to the invention is shown in the figures 1 – 3, any lifting and lowering platforms or lifting tables can be implemented with the apparatus according to the invention.

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The plastic material of the parts 2 – 4 is most advantageously polyamide as such or mixed with some known mineral fillers in order to improve the material properties such as in order to reduce friction in the threads or in order to improve weather resistance.

Further the plastic material of the parts can be reinforced with known fibre reinforcements, the external surface of the parts can be reinforced with fibres or reinforcement net. Also the surfaces of the threads can be treated or coated with nanotechnology in order to reduce friction.

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**CLAIMS**

1. Lifting/lowering apparatus, such as a plane that can be lifted, a table or a lifting  
5 platform construction, equipped with at least two adjacent lifting mechanisms that can be  
telescopically extended which lifting/lowering apparatus comprises a lower frame (1),  
further a horizontal upper frame (7) supported by which a plane, such as a working plane  
(5), (6) is adjusted and comprises a lifting mechanism adjusted between the mentioned  
lower frame and upper frame with the help of which lifting mechanism the upper frame  
10 (7) can be lifted and lowered in relation to the lower frame (1) and that the lifting  
mechanism comprises adjacent pillars (2, 3, 4) in which case each pillar is formed of  
cylinder parts (2 – 4) that can be moved telescopically in relation to each other which  
cylinder parts are attached to each other with the help of threads in such a way that the  
rotation of the parts (2 – 4) in relation to each other changes the height of the mentioned  
15 pillars, characterized in that in order to reduce the construction weight the cylinder parts  
(2 – 4) are made of plastic and in order to improve the receiving of sideway loadings, the  
inner diameter (d) of the cylinder part (4) having the smallest diameter is over 200 mm.
2. Lifting/lowering apparatus according to the claim 1, characterized in that the  
20 lowermost parts (2) of the pillars are attached to the base (1) in a non rotatable way.
3. Lifting/lowering apparatus according to the claim 2, characterized in that the upper  
frame (7) comprises a rotating motor (9) with the help of which the rotating parts (3, 4)  
of the pillars can be rotated.  
25
4. Lifting/lowering apparatus according to the claim 1, characterized in that the lower  
frame (1) comprises a rotating motor (9) with the help of which the lowest, rotating parts  
(2, 3) of the pillars can be rotated.
- 30 5. Lifting/lowering apparatus according to the claim 1, characterized in that wall  
thicknesses defined on the grounds of allowed loadings are chosen for the parts (2 – 4) of  
the pillars in which case the parts (2 – 4) of the pillars are meant to receive all allowable  
vertical and sideway loadings conveyed through the upper frame (7).

6. Lifting/lowering apparatus according to the claim 1, characterized in that the threads of each part (2 – 4) are equipped with a pitch of equal size per a cycle.
- 5 7. Lifting/lowering apparatus according to the claim 1, characterized in that the threads of the parts (2 – 4) have a profile equal to trapeze threads.
8. Lifting/lowering apparatus according to the claim 1, characterized in that the parts (2 – 4) are made of polyamide plastic or made of mixed/reinforced polyamide plastic.
- 10 9. Lifting/lowering apparatus according to the claim 1, characterized in that the density of the material of the plastic parts (2 – 4) is under 1,4 kg/dm<sup>3</sup>.
- 15 10. Lifting/lowering apparatus according to the claim 1, characterized in that the external surfaces of the parts (2 – 4) are reinforced with fibre or net reinforcements.

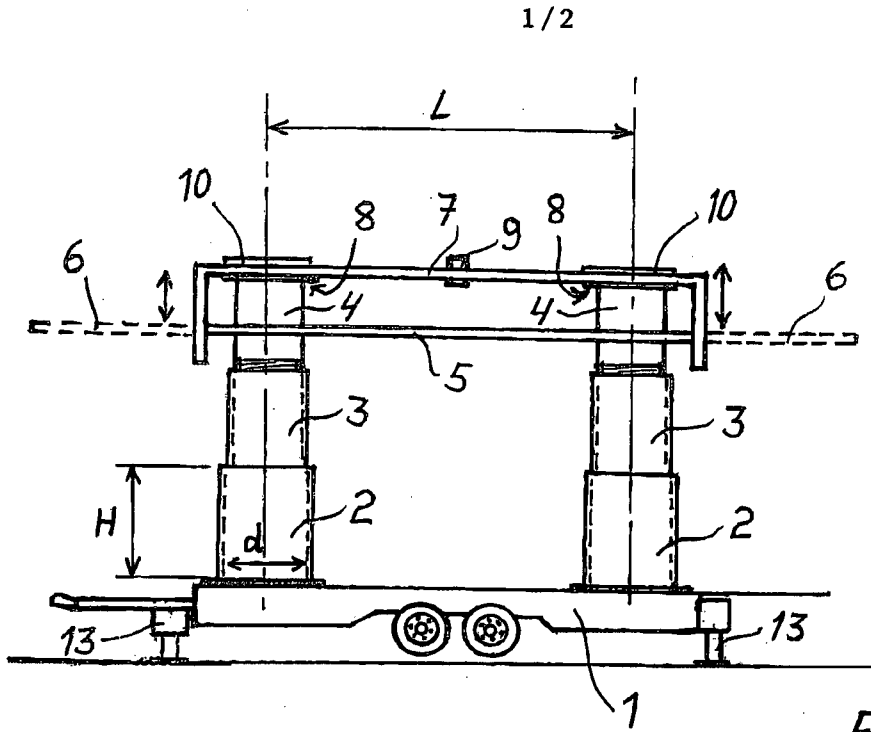


Fig. 1

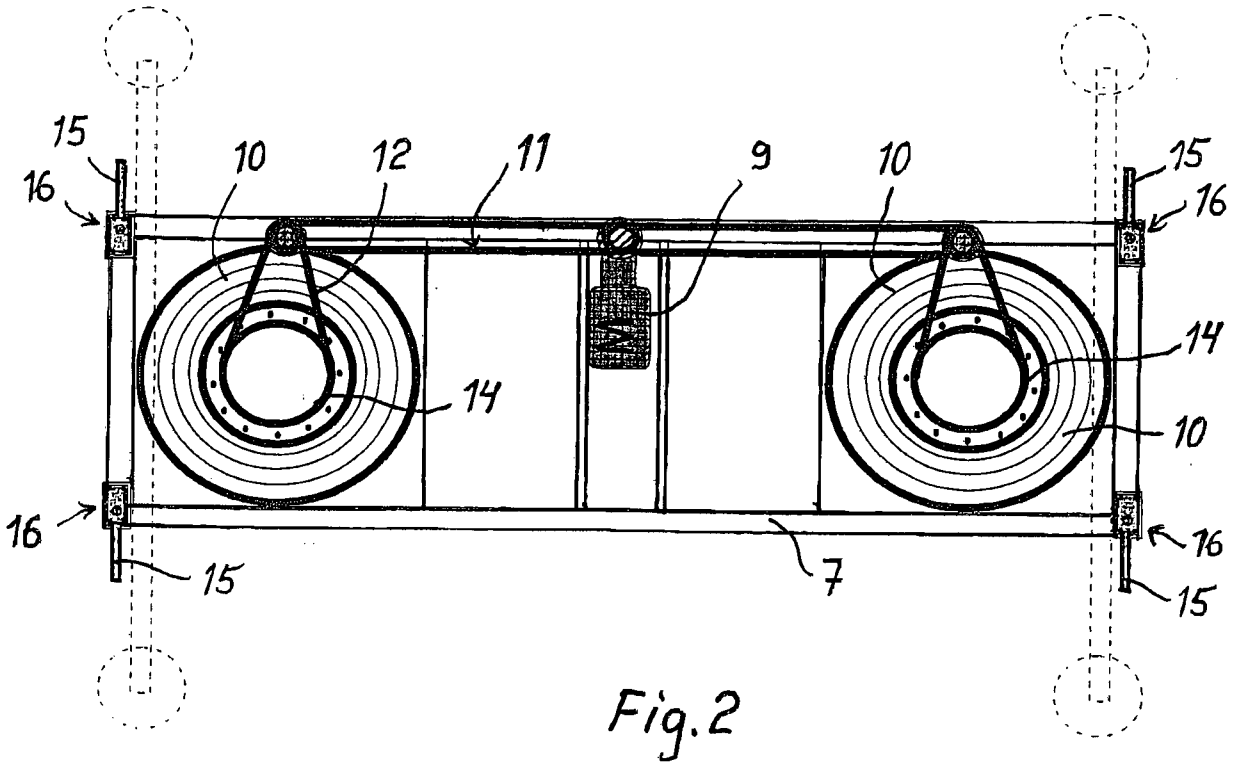


Fig. 2

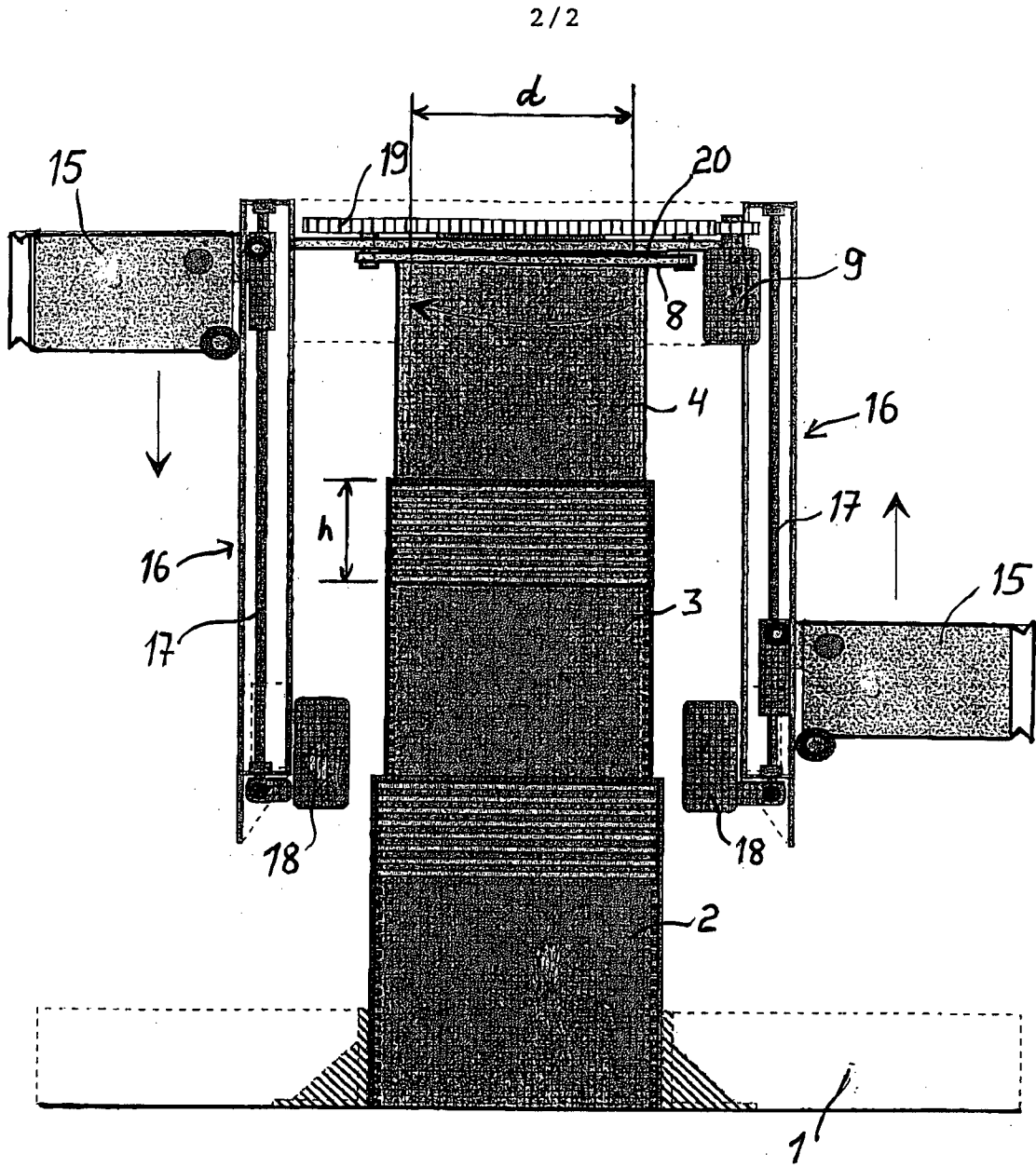


Fig.3

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2011/000006

## A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: B60P, B62D, B66B, B66F, E04F, E04G, F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
FI, SE, NO, DKElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
EPO-Internal, WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 19910545 C1 (DUCHMANN KLAUS) 06 July 2000 (06.07.2000) whole document	1-3, 5-10
Y	DE 19818821 A1 (GOBBERS DIETER et al.) 04 November 1999 (04.11.1999) column 1, lines 48-54; column 2, line 9 - column 4, line 10; figures 1-9, 12-13	1-3, 5-10
A	US 5172442 A (BARTLEY GARY L et al.) 22 December 1992 (22.12.1992) column 3, lines 3-39; figures 1-2	1-3, 5-10

 Further documents are listed in the continuation of Box C.
  See patent family annex.

\* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

17 June 2011 (17.06.2011)

Date of mailing of the international search report

20 June 2011 (20.06.2011)

Name and mailing address of the ISA/FI  
National Board of Patents and Registration of Finland  
P.O. Box 1160, FI-00101 HELSINKI, Finland

Facsimile No. +358 9 6939 5328

Authorized officer  
Lauri Louhiluoto

Telephone No. +358 9 6939 500

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: 4  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
According to the description the lowermost parts (2) of the pillars are attached to the base (1) in a non-rotatable way; "Kun alimmat osat 2 ovat kiinni alustassa 1 pyörimättömästi..." (see page 2, last three lines). Neither the description nor the figures give any support or hint for the kind of embodiment defined in claim 4, which states that the lowermost parts (2) of the pillars can be rotated.
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.  
PCT/FI2011/000006

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
DE 19910545 C1	06/07/2000	None	
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DE 19818821 A1	04/11/1999	US 6158809 A	12/12/2000
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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

**B66F 7/14** (2006.01)

**B66F 11/04** (2006.01)

**B66F 3/10** (2006.01)