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(54) LIFTING UNIT

(57) The invention is provided to securely lift and displace extremely heavy loads (for example prefabricated buildings, shipping containers, etc). The presented lifting unit (1) comprises a telescopic fastening column (2) formed by two parallel columns, a lower supporting slab (3), an upper fastening plate (6), a hydraulic lifting cylinder (4) with a piston positioned between the columns and angled supporting posts (5) connected to the supporting slab and columns. There are four lifting units wherein the lifting cylinders are operated as three-point system. Optional fastening means (7, 8, 9, 10) are used to lift and displace the object more securely.

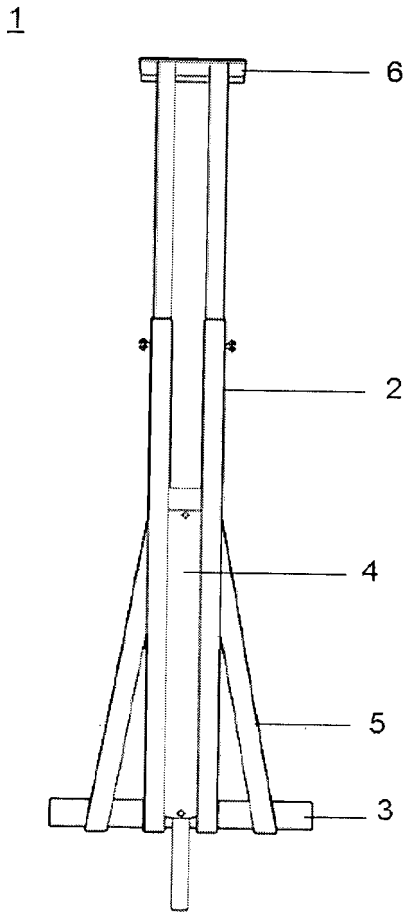

FIG 1

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Description

Technical field

[0001] The invention concerns safe lifting and transfer of heavy objects.

Prior art

[0002] Transferring and transporting especially heavy objects with the weight of multiple or tens of tons is complicated and laborious. The purpose of the presented solution is to facilitate the safe transfer and shifting of such heavy objects and to protect the structure or interior decor of the objects against damages in the course of lifting and transfer (such as prefabricated buildings, where the interior decor can suffer damages during lifting and transfer).

[0003] Known is a lifting system (US2009026430 A1, Simplified Lifting Systems LLC, published 29.01.2009), which is intended for lifting and transferring structures, buildings, machines and other massive and large objects, while beams are also used in lifting the object. The lifting system comprises one or more lifting devices, which are adjustably connected via a support plate installed under the object. A lifting device includes force elements, a support element and lifting elements that lift the object to a specific height. A drawback of this solution is the low lifting height of the lifting device, due to which lifting must be repeated in order to achieve the required lifting height, using additional base plate for the purpose. This, however, makes the whole lifting process time-consuming. Moreover, the lifted object is not fixed to the lifting device, wherefore the safety of lifting the object is not guaranteed. The solution also includes no possibility to transfer the lifted object.

[0004] A device closest to the invention by its technical nature is a lifting device (US8573564 B2, Rashall R. J, published 07.07.2011), which allows lifting and transferring heavy items. The lifting device comprises a square base for the lifting device, installed on the ground, with lateral supports at a right angle pointed away from the lifted item and either bolted or welded to the base. The lifting device comprises a lifting cylinder with a piston head, and an upper and lower end of the piston head. The piston head moves up and down inside the cylinder through a cylinder opening. The lower end of the piston head is attached to the lifting device base. The lifting device comprises a lifting assembly, which has an upper square support plate installed in respective slits of the first and second support post, and the support posts are bolted or welded at the bottom to vertically extendable posts, a lifting plate is attached to the lateral frames. The lifting assembly is attached to the piston assembly, the upper end of the piston head is installed into an opening in the piston cover. The piston assembly and the lifting assembly are located in a housing with slits. A drawback of this solution is that the lifting plate lifts the object by 10 to 27 cm at a time, limiting the possibility of transfer. The lifted item is also not attached to the lifting device, causing the item to swing during the lifting and transfer and thereby potentially damaging the structures and interior decor of the lifted object (such as a prefabricated building). The existence of lateral supports and a square support plate also do not prevent lateral twisting (in parallel with the lifted object) of any of the lifting devices or falling of these under heavy weight.

Description of the invention

[0005] This invention allows safe lifting and transferring of extremely heavy objects (such as prefabricated buildings, shipping containers, etc.). The presented lifting unit comprises a telescopic fastening column, a lower supporting slab, an upper fastening plate, a hydraulic lifting cylinder with a piston, supporting posts to support the lifting cylinders. There are four lifting units, while the lifting cylinders function as a three-point system. Optional fastening, tensioning and adjustment devices are used for further safety in lifting and transferring the lifted object.

List of figures

[0006]

Figure 1 shows the lifting unit;

Figure 2 shows lifting of an object by means of the lifting unit, whereby the object is mounted to the lifting unit between telescopic fastening columns wherein the supporting slab and fastening plate are the boundaries;

Figure 3 shows lifting of an object by means of the lifting unit, wherein additional fastening bars are used;

Figure 4 shows lifting of an object by means of the lifting unit, wherein additional fastening chains are used;

Figure 5 shows the tensioner of the lifting chains.

Embodiment of the invention

[0007] Lifting unit 1 comprises a telescopic fastening column 2 with adjustable height, consisting of two parallel columns, between which the lifting cylinder 4 with a piston has been placed. A supporting slab 3 is attached to the lower end of the telescopic fastening column 2, and a rectangular fastening plate 6 to the upper end. In comparison to the fastening plate 6, the supporting slab 3 is substantially longer. The object to be lifted is fixed to the lifting unit 1 between supporting slabs 3 and fastening plates 6, while the vertical grasp of supporting slabs 3 and fastening plates 6 can be adjusted with telescopic

fastening columns 2, proceeding from the height of the object to be lifted.

[0008] Supporting slabs 3, fastening plates 6 and telescopic fastening columns 2 also ensure the stability of the lifted object. Supporting slab 3 is substantially longer in comparison to its width, and the longer side of the rectangular fastening plate 6 runs along the longer side of the lifted object. Such design of the supporting slab 3 and fastening plate 6 ensure better horizontal support of the lifted object and no horizontal tilting during the lift. Telescopic fastening columns 2 make sure that the lifted object (e.g. wall of a prefabricated building) will not deflect in height during lifting.

[0009] Supporting slabs 3 and fastening plates 6 fix the lifted object to telescopic fastening columns 2. In such way the lifted object is surrounded by grippers on its sides.

[0010] At the lower and upper ends of the telescopic fastening column 2 are optional fasteners to fasten the object more securely to the lifting unit. Fastening bars 7 and fastening chains 8 are such supplementary fasteners.

[0011] Fastening bar 7 connects on the surface two lifting units 1, which are on the opposite sides of the lifted object, through fastening plates 6. Fastening bars 7 are adjustably attached to fastening plates 6, which means that the height of the bars can be adjusted with an adjusting device 9 according to the width of the object to be lifted.

[0012] Fastening chain 8, which is led underneath the object to be lifted, joins two lifting units 1 that are on the opposite sides of the object to be lifted. The rigidity of lifting chains 8 can be adjusted with a tensioner 10, which is preferably a ratchet type load binder, one end of which is fastened to the telescopic fastening column 2. Preferably, two fasteners 1 are mutually connected, using two fastening chains 8.

[0013] Fastening bars 7 and fastening chains 8 make sure that the supporting slab 3 and fastening plate 6 are securely fixed to the object to be lifted, ensuring thereby further stability of the object to be lifted. This is especially important, for example, in case of prefabricated buildings, when any instability in lifting and transfer can damage the structures and/or interior decor of the building. In such way, the lifted object is surrounded by grippers.

[0014] The parallel columns of the telescopic fastening column 2 and the supporting slab 3 are mutually connected with supporting posts 5 which are at an acute angle and are placed in parallel with the object to be lifted, providing the lifting cylinder 4 with further rigidity and securing it against lateral deflection.

[0015] The lifting cylinder 4 is hydraulic and manually operable. In the invention, four lifting cylinders 4 are used for lifting the object, whereby two lifting cylinders are positioned at the immediate vicinity of the ends of the longer side of the lifted object, and two lifting cylinders at approximately one third in the length of the longer side of the lifted object, away from the opposite ends. The lifting cylinders close to the ends of the object operate independently (lift with equal force), while the lifting cylinders away from the opposite ends operate as a pair, where the cylinder with the least load lifts, while the other compensates the lifting force of the lifting cylinder when necessary. As such, the lifting cylinders function as a three-point lifting system.

[0016] The lifted object fixed to the fastening units 1 is lifted by means of lifting cylinders 4 vertically up to the required height, so that a means of transport could be manoeuvred underneath it to transport the object lowered to it to another location. In the new location the object is once again lowered to a required place, using fastening units 1 together with lifting cylinders 4.

[0017] The invention is convenient for safe lifting and transfer of primarily square objects (such as prefabricated buildings or shipping containers). At the same time it can be successfully used with prefabricated buildings with a gable roof or other types of roofs.

Claims

1. A lifting unit, which includes fastening columns and their lateral supports and a lifting cylinder with a piston, **characterized in that** the lifting unit (1) comprises a telescopic fastening column (2) formed by two parallel columns, a hydraulic lifting cylinder (4) with a piston, positioned between the columns, a supporting slab (3) attached to the lower end of the telescopic fastening column (2) and a rectangular fastening plate (6) fixed to the upper end, supporting posts (5), which are at an acute angle to the lifted object positioned between the parallel columns and a supporting slab (3), and optional fastening, tensioning and adjustment means, while lifting and lowering of the object is executed as a three-point lifting system of lifting cylinders (4).

2. A lifting unit according to claim 1, **characterized in that** the supporting slab (3) is longer in comparison to the fastening plate (6) and the supporting slab (3) is longer in comparison to its width and the longer side of the rectangular fastening plate (6) is placed along the longer side of the object to be lifted.

3. A lifting unit according to claims 1 and 2, **characterized in that** the lifted object is fastened to the lifting unit (1) between the supporting slab (3) and fastening plate (6) in all its height on all sides, while the vertical grasp of the supporting slab (3) and the fastening plate (6) is adjusted with the telescopic fastening column (2), proceeding from the height of the lifted object.

4. A lifting unit according to claims 1 to 3, **characterized in that** the fastening means is a fastening bar (7), which is connected on the surface of the lifted object

to the fastening plates (6) of lifting units (1) on opposite sides, and also comprises an adjustment device (9) which is used for adjusting the length of the fastening bar (7) on the basis of the width of the lifted object.

5. A lifting unit according to claims 1 to 3, **characterized in that** the fastening means is a fastening chain (8), which is led under the lifted object and connected to lifting units (1) on opposite sides by means of a tensioner (10), which is fixed to the telescopic fastening column (2) on one end and tensions the fastening chains (8), depending on the width of the lifted object.

6. A lifting unit according to claim 5, **characterized in that** the fastening means (10) is a rachet type load binder.

7. A lifting unit according to claims 1 to 6, **characterized in that** there are four lifting units (1) with lifting cylinders (4), two fastening bars (7) and four fastening chains (8).

8. A lifting unit according to claims 1 to 7, **characterized in that** two lifting units (1) with lifting cylinders (4) are placed in immediate vicinity to the ends of the longer side of the lifted object and two lifting units (1) together with lifting cylinders (4) are placed away from the opposite ends, at approximately one third of the length of the longer side of the lifted object.

9. A lifting unit according to claims 1 to 8, **characterized in that** the three-point lifting system of the lifting cylinders (4) is executed so that the lifting cylinders (4) close to the ends of the lifted object are executed to operate independently with equal force, while the lifting cylinders (4) away from the opposite ends of the lifted object are executed to function as a pair, so that the lifting cylinder (4) with the least load lifts and lowers and the cylinder, which operates as its counterpart, compensates the lifting power of the operating lifting cylinder (4) as needed.

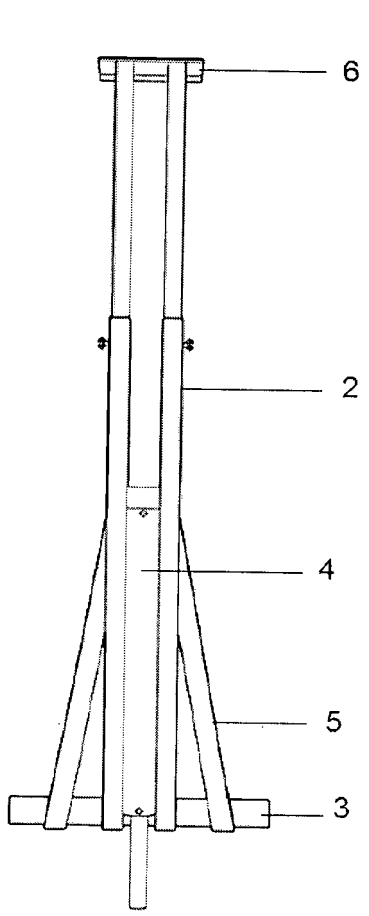

FIG 1

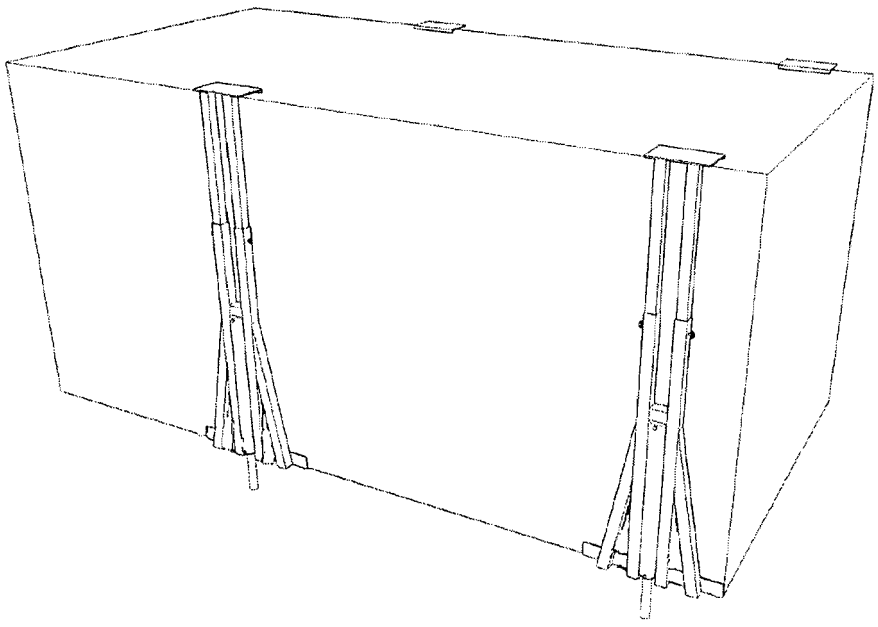

FIG 2

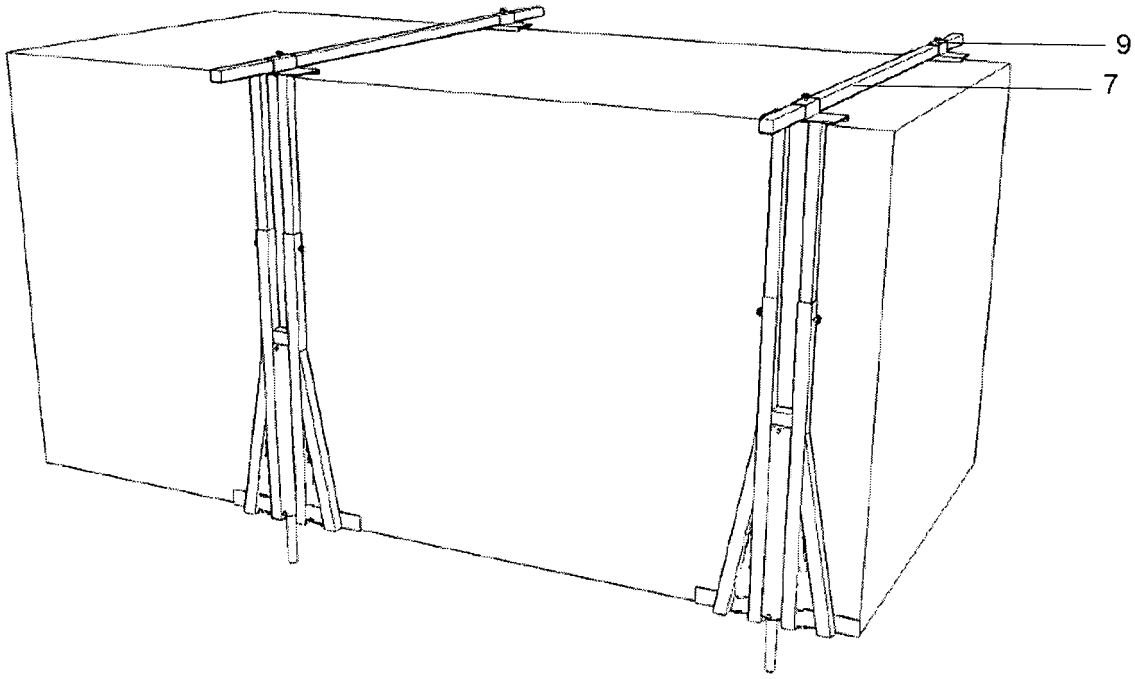

FIG 3

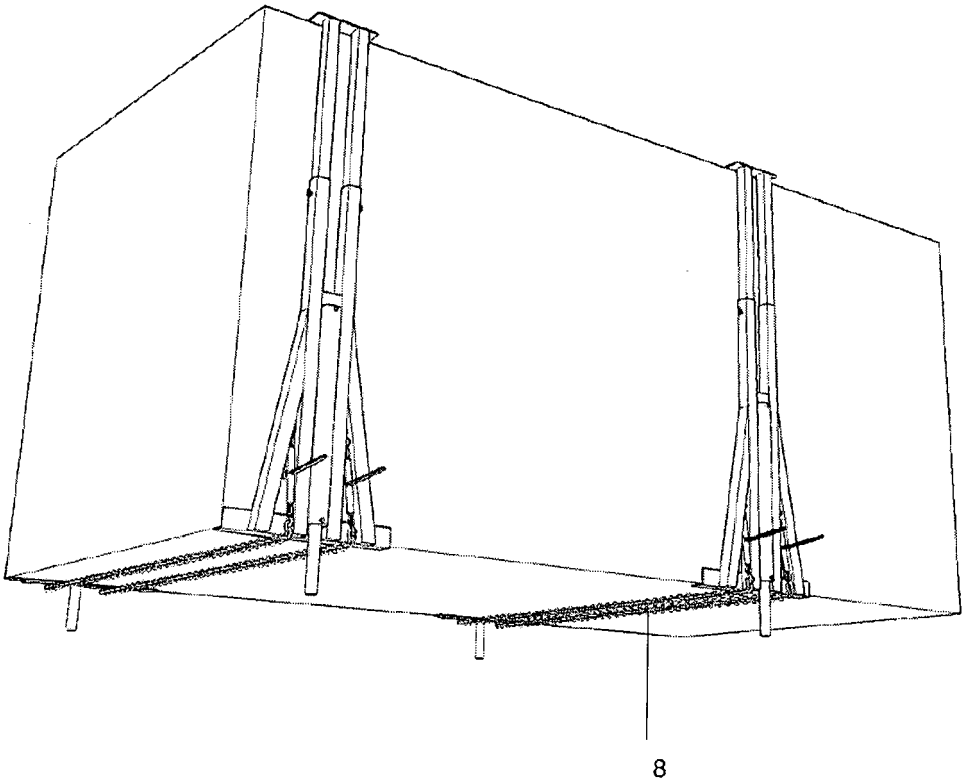

FIG 4

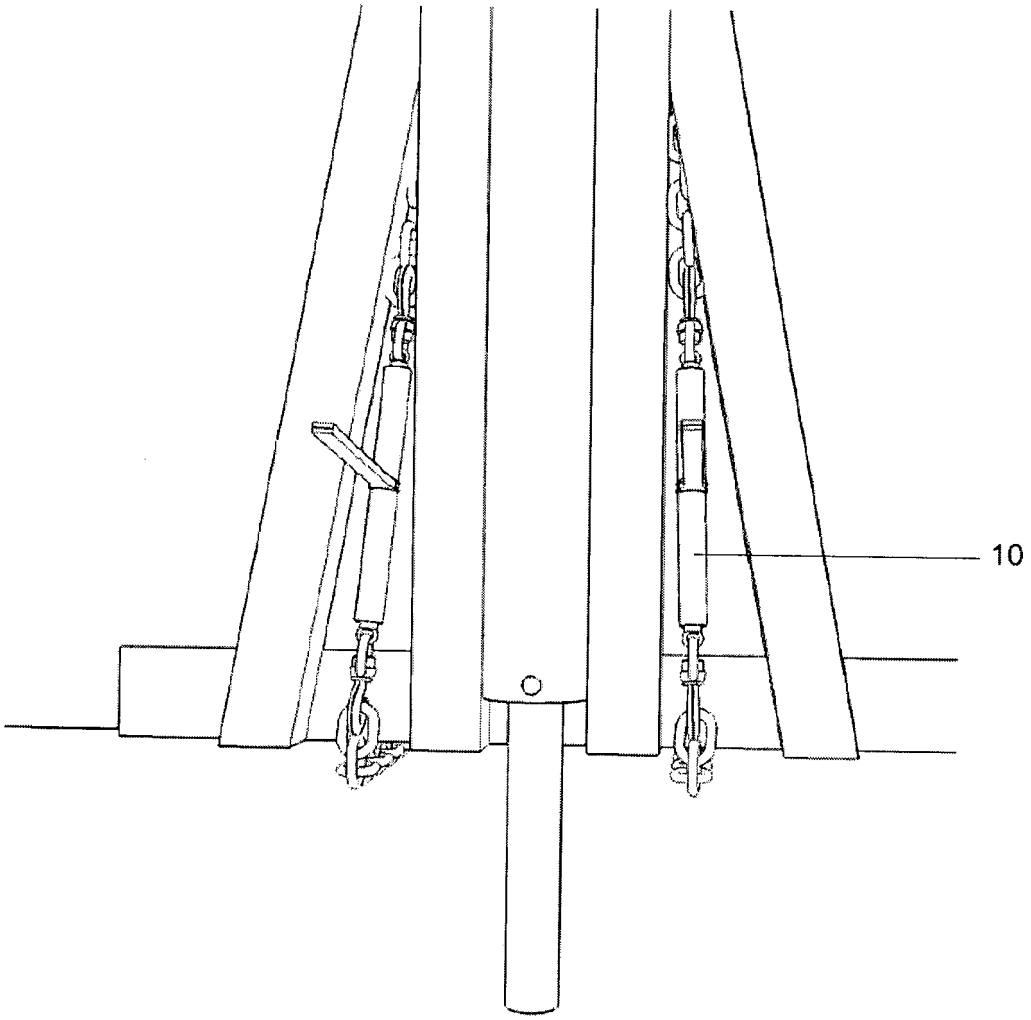

FIG 5

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EUROPEAN SEARCH REPORT

Application Number
EP 19 00 0262

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 8 573 564 B2 (RASHALL RICHARD J [US]) 5 November 2013 (2013-11-05) * the whole document *	1	INV. B66F3/46 E04B1/35
A	US 2017/327357 A1 (BAINTER WESLEY ALLEN [US] ET AL) 16 November 2017 (2017-11-16) * abstract * * paragraph [0062] - paragraph [0080] * * figures *	1	
A	US 7 100 896 B1 (COX HENRY [US]) 5 September 2006 (2006-09-05) * abstract * * figures *	1	
A	EP 0 077 369 A1 (TMG LTD [GB]; STOOF PIETER MARIA [NL]) 27 April 1983 (1983-04-27) * abstract * * figures *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B66F
E04B
B60P
B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 October 2019	Sheppard, Bruce

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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14-10-2019

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- US 8573564 B2, Rashall R. J **[0004]**