(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2012 (07.06.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/074410 A1

(51) International Patent Classification:
B25J 9/00 (2006.01) *B25J 13/00* (2006.01)
B25J 9/02 (2006.01)

(21) International Application Number:
PCT/NO2011/000336

(22) International Filing Date:
1 December 2011 (01.12.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
20101689 2 December 2010 (02.12.2010) NO

(71) Applicant *(for all designated States except US)*: **NORSK HYDRO ASA** [NO/NO]; N-0240 Olso (NO).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **LINDHEIM, Tomas** [NO/NO]; Marstranderveien 15, NO-1369 Stabekk (NO). **LIEDTKE, Ralf** [DE/DE]; Schlängbaum 91, NO-28259 Bremen (DE).

(74) Agent: **BERG, André**; Intellectual Property Department, Hydro Aluminium AS, N-0240 Oslo (NO).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: METHOD AND SYSTEM FOR HANDLING OBJECTS

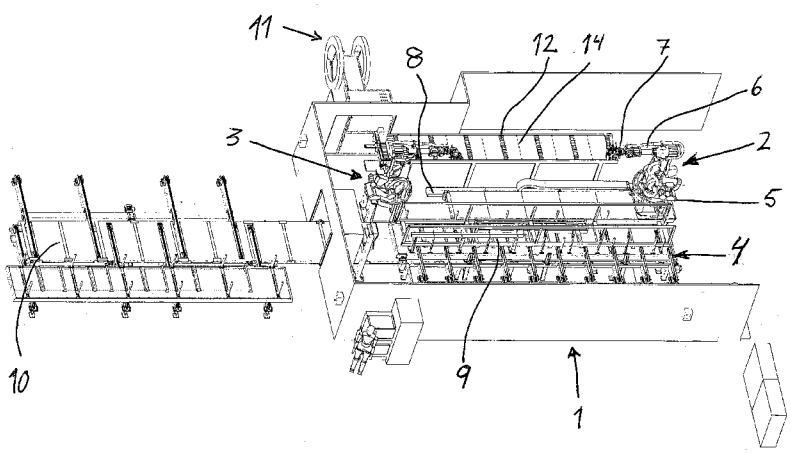


Fig. 1

(57) **Abstract**: The invention relates to a method and a system for handling long objects, in particular packing extruded profiles. It comprises two robots with one arm each, said arm having a pair of grippers, and a control unit that coordinates and controls the movement of the robots. In the handling operation the mutual distance between the two said pair of grippers are held constant, to counteract misalignment of the object.

WO 2012/074410 A1

Method and system for handling objects

The present invention relates to a method and a system for handling objects. In particular the invention relates to handling and packing long, light weighted objects.

WO 2005009691 discloses a system for handling heavy objects, where two crane based manipulators handle an object. Each manipulator has one arm with gripping means at their outermost ends, whereby the gripping means hold the object at its extremities during handling.

The present invention consists mainly of two floor arranged manipulators or robots of the pedestal type, where at least one of them is arranged for linear movement towards the other, to compensate for handling objects of variable lengths.

In relation to aluminium extrusion facilities there is a certain need for handling and packing extruded profiles. Such profiles can have rather slim cross-sections while their lengths can commonly be up to approximately 7 metres and in some cases even more. The internal handling operations related to stacking, packing before shipping, or other operations, are commonly done manually. Thus, due to the size and properties of the objects, two operators are needed to handle them. Normally, the operators grip one end of the object each, and due to sagging in the vertical plane or bending in the horizontal plane of the object they have to avoid the object touching the base or other physical attributes to avoid scratching of the objects surface.

Often profiles with surface finish are packed into boxes of wood, plastics or the similar, with protecting spacers between them sideways and also between the layers of profiles. Such spacers can be represented by strips of cartoon, corrugated paper or the similar.

In accordance with the invention it is now possible to replace monotonous manual handling of long, tiny object by an automatic packing facility, and at the same time reduce the risk of damages at the surface of the object during the handling operation.

This and further advantages can be achieved with the invention in accordance to the accompanying claims.

In the following, the invention shall be described by example and figures where:

Fig. 1 discloses a packing facility, seen in perspective from above,

Fig. 2 discloses a gripper designed for the purpose of profile handling and packing and spacer handling,

Fig. 3 discloses an alternative embodiment of the outer section of one robot, including a gripper.

Fig. 1 discloses a packing facility 1 where two robots 2, 3 are arranged to handle profiles entering a table 4 from an extrusion press (not shown). The robots shown are of pedestal type having a base 5, one arm 6 and gripper 7 (see robot 2). In this embodiment the robot 2 is further arranged for linear movement along a track 8, to compensate for objects of varying length.

The movements of the two robots are coordinated and controlled by a control unit (not shown). The arms of the robots are articulated about multiple axes to engage and handle the object. The control unit controls articulation and displacement of the robot arms.

Preferably the robots are of a 6 axis industrial robot type, where at least one could be arranged for linear movement along a track.

Further, the control unit communicates with a recognition unit that determines what type of object that has to be handled by the robots. Object specific parameters such as cross-section configuration, thickness etc. can be determined by this unit. The recognition unit can comprise at least one camera that images the end of the object, whereby the image is processed to decide crucial cross-section information. It should be understood that any other convenient vision system may be applied.

The control unit will process this information and, if necessary a change of gripper will be done before the object is handled. The change can be done in an automated manner while the robots are commanded to approach a tooling station with appropriate grippers. Such change of tooling and the arrangement thereof, is in general commonly known to those skilled in the art and will not be further described here.

The objects will be picked up and lifted by the coordinated movements of the robots. The problems with sagging of the objects have been solved by the robots being controlled in a

way where the distance between the grippers are constant during handling. Therefore, the objects will be very little prone to sagging.

In an alternative, the robots can be controlled in such a way that a set tension is applied between the grippers, to stretch the profile at some extent. Such tension can be applied immediately after the grippers engage the object, i.e. before it is lifted up from its storing position, or it can be applied during the lifting/handling operation. In the alternative a set tension or pre-tension of the object is applied, the grippers are held at a constant distance after application of this tension.

The object picked up from table 4 by the robots is in this embodiment moved to a stacking unit, a shipping box or the similar (not shown) arranged on conveyer 9. As one unit is ready for shipment, it leaves the facility at conveyer 10.

At position 11 there is disclosed a spacer preparation unit. This unit provides spacers for the packing operation and communicates with conveyor 14 where spacers 12 are evenly distributed for being picked up by the robots and put in place during the packing operation. Both flat spacers and flat spacers with vertical walls can be handled by this arrangement.

In Fig. 2 there is disclosed a gripper arrangement that has been designed as a part of the invention. An actuator 20 is arranged to move one first base 21 relatively one second base 22. The bases are linearly movable by means of a set of linear bearings 23, 24 each consisting of an inner guide element 25 and an outer guide element 26.

The first base 21 has two grippers 30, 31 attached to it. Similarly, the second base 22 also have two grippers 32, 33 attached to it. The grippers 30, 32 and the grippers 31, 33 are mutually applied to grip the end of the object. One advantage with this gripper design is that it can be arranged at the robot arm in a manner where it can be rotated to use either the first set of grippers or the second one. In particular this is useful when the robots handle profiles and spacers in alternating operations.

Preferably the grippers (see gripper 32) have a slight wedge shape with regard to their side flanks 35 from their base part 36 towards their tip section 34. Preferably, their gripping faces are planar and may have a coating, a layer or the similar that secures a good friction contact with the object. This gripper design is in particular advantageous for handling objects such as extruded profiles.

The gripper 33 has one projecting part 37 that is pin shaped and provided with a converging end. The pin is arranged there for calibrating purposes.

Fig. 3 discloses an alternative embodiment of the outer section of one robot, where two grippers 130, 132 can be operated as follows:

The grippers can be moved towards each other by means of a linkage system 140, attached to a bracket 149, by the activation of a rod 148. The rod is moved by a lever 146, 144, which is attached to it via pivot 147. The lever is hinged at a pivot 145 and is at its opposite end connected with a piston rod 142 of an actuator 141 via pivot 143.

When activating the actuator 141, causing the rod 148 to move, the linkage system 140 will be moved relatively to the bracket 149, and the grippers 132, 130 will be moved towards or away from each other, depending upon the direction of movement of the rod 148.

Further, the gripper arrangement is provided with means for non-limited rotation. The bracket 149 is arranged for rotation with respect to the pivot 147. For instance it can be fixed to a sleeve 155 coaxial to the rod 148, where the sleeve at its other end is driven by means of a step motor 152. The motor engages the sleeve via a transmission belt 151 and toothed wheels 153,150. Bearings are arranged at pos. 154 and 155.

The outer section of the robot further has at least one vacuum operated gripper, see pos. 156. These grippers are arranged in a movable frame, and can be moved by an actuator, and can be used for handling spacing material in a packing process.

In this embodiment, it also has grippers designed for handling flat spacers, partly shown in the figure at pos. 157. These type of grippers normally comprise two 90° angled bars that operates in pair and are lowered onto the actual flat spacer to be gripped with a horizontal part of the bar laying onto the upper surface of the spacer and a vertical part of it at the side edge thereof.

It should be understood that the system can be provided with means for determining the type of object and that the movements of the robots can be controlled by a programmable control unit (not shown). Such means can be automatic vision based scanning means.

It should be understood that the system can handle a wide range of objects and various profile shapes, and the packing method is qualified for both horizontal and vertical separation of the objects.

The robots can be of a commercially available type with preferably 6 axis, modified in accordance to the present invention.

In operation, the object is gripped at its ends by means of two synchronous robots with one arm each, said arm having a pair of grippers, whereby the two pair of grippers are maintained at constant mutual distance in the handling operation, to counteract misalignment of the object. Preferably, a tension is set up between the two pair of grippers during handling.

A synchronised rotation of the objects ends along one axis following the length direction of the object can be performed by the two pair of grippers during handling. Preferably, the object is rotated in this manner so that its centre of gravity is in vertical alignment with the two pairs of grippers.

Preferably, a rotation about a horizontal axis, perpendicular to the length axis of the object at each of the object's ends can be performed during handling, the rotation being in opposite directions, to counteract sagging of the object.

Claims

1. Method for handling long objects, in particular packing of extruded profiles,
characterised in that
the object is gripped at its ends by means of two synchronous robots with one arm each, said arm having a pair of grippers, whereby the two pair of grippers are maintained at constant mutual distance in the handling operation, to counteract misalignment of the object.

2. Method in accordance to claim 1,
characterised in that
a tension is set up between the two pair of grippers during handling.

3. Method in accordance to claim 1-2 ,
characterised in that
a synchronized rotation of the objects ends along one axis following the length direction of the object is performed by the two pair of grippers during handling.

4. Method in accordance to claim 3
characterised in that
the object is rotated so that its centre of gravity is in vertical alignment with the two pairs of grippers.

5. Method in accordance to claim 1-4
characterised in that
a rotation about a horizontal axis, perpendicular to the length axis of the object at each of the objects ends is performed during handling, the rotation being in opposite directions.

6. System for handling long objects, in particular packing extruded profiles, comprising two robots with one arm each, said arm having a pair of grippers, and a control unit that coordinates and controls the movement of the robots,
characterised in that
in handling operation the mutual distance between the two said pair of grippers are constant, to counteract misalignment of the object.

7. System in accordance to claim 6,
characterised in that
at least one arm has vacuum operated grippers.

8. System in accordance to claim 6 ,
characterised in that
at least one arm has grippers designed for handling flat spacers.

9. System in accordance to claim 6 ,
characterised in that
it has means for determining the type of object and that the movements of the robots are controlled by a programmable control unit.

10. System in accordance to claim 6,
characterised in that
the robots are of a six axis industrial robot type.

11. System in accordance to claim 6,
characterised in that
at least one robot is arranged for linear movement.

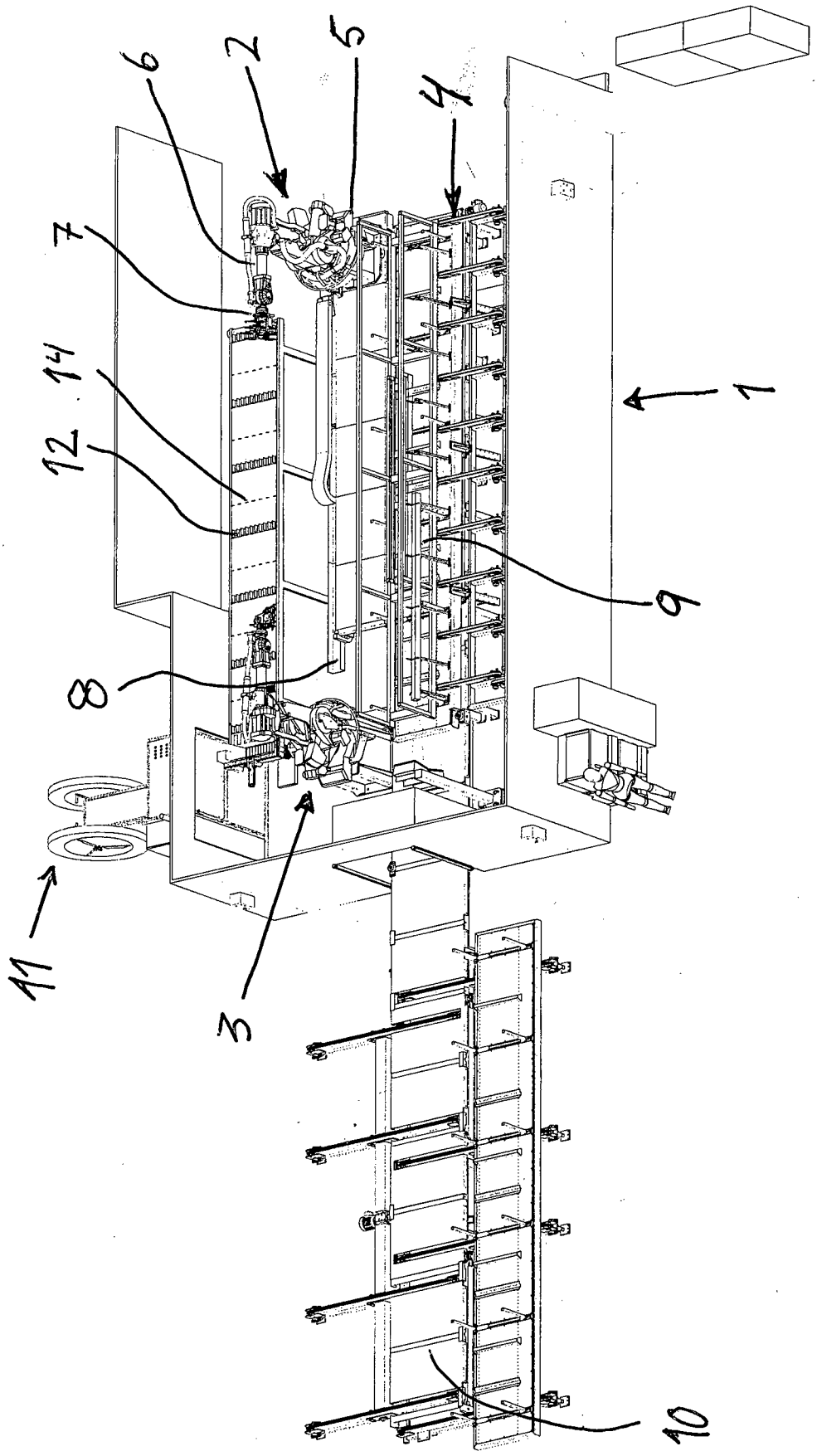


Fig. 1

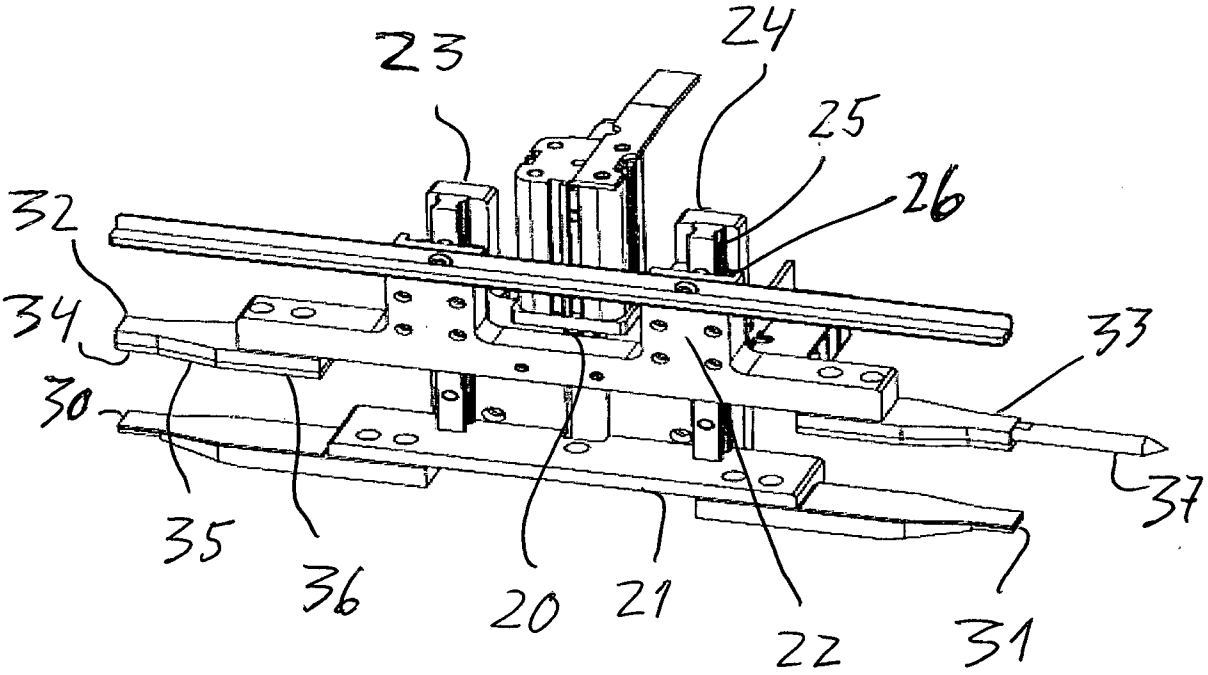


Fig. 2

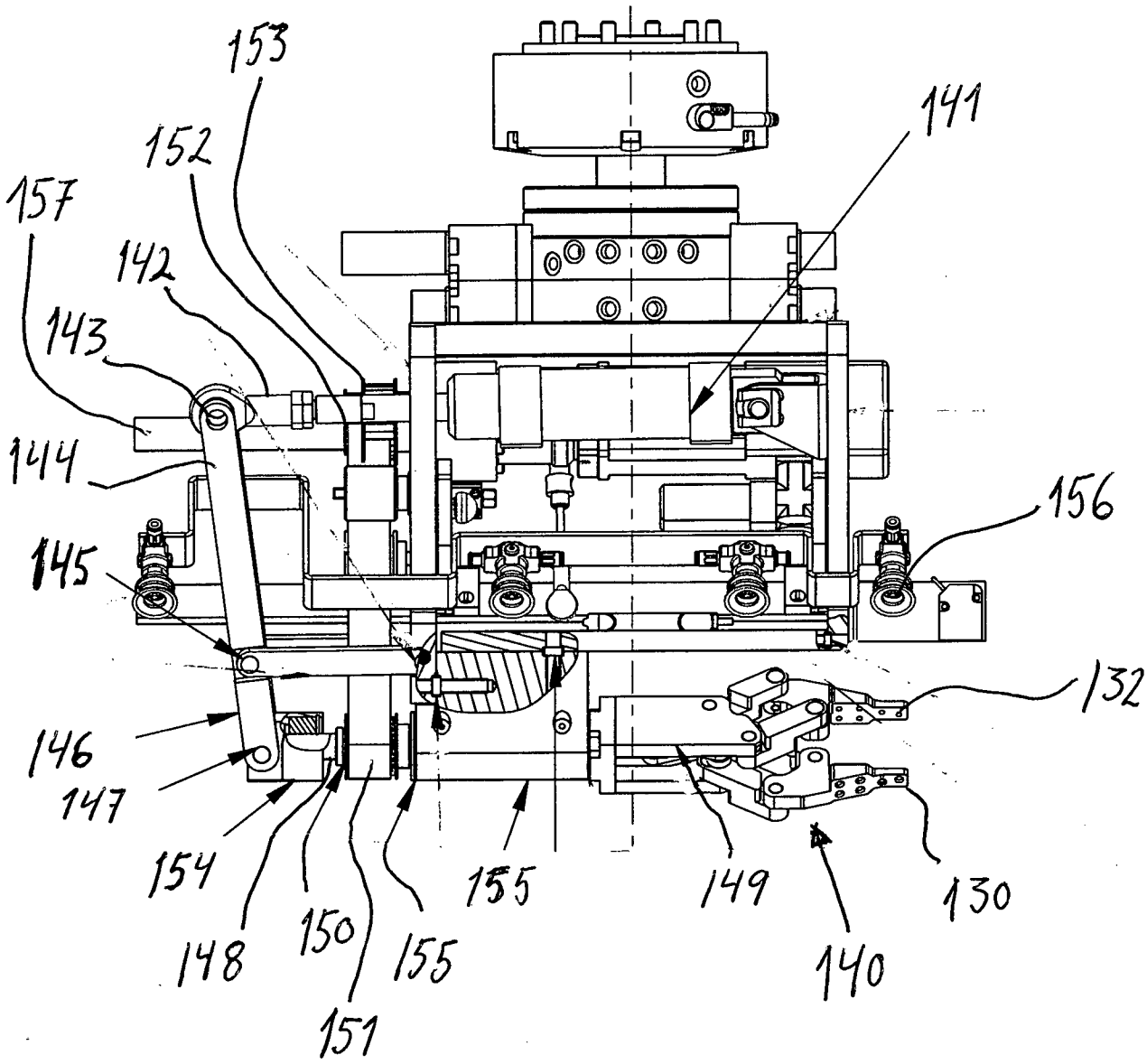

153
152
157
142
143
144
145
146
147
154
148
150
151
155
155
149
140
130
132
156
141

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2011/000336

A. CLASSIFICATION OF SUBJECT MATTER

B25J 9/00 (2006.01), B25J 9/02 (2006.01), B25J 13/00 (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)

B25J

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

DK, NO, SE, FI: classes as above

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

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2005009691 A1 (FANUC ROBOTICS AMERICA, INC.) 2005.02.03 Whole document	1-11
A	JP 2002336994 A (HITACHI ZOSEN CORP) 2002.11.26 Whole document	1-11
A	EP 2060367 A2 (AIDA ENGINEERING LTD.) 2009.05.20 Whole document	1-11

☐ 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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23/02/2012	28/02/2011
Name and mailing address of the ISA/ Nordic Patent Institute Helgeshoj Allé 81, DK-2630 Taastrup, Denmark Facsimile No. (+45) 43 50 80 08	Authorized officer Hodneland, John André W. Telephone No. (+47) 22 38 75 46

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NO2011/000336

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2005009691 A1	2005.02.03	US 2005036879 A1	2005.02.17
		EP 1648664 A1	2006.04.26
		CN 1839018 A	2006.09.27
		JP 2006528082 A	2006.12.14
JP 2002336994 A	2002.11.26		
EP 2060367 A2	2009.05.20	CA 2641137 A1	2009.05.16
		US 2009129900 A1	2009.05.21
		JP 2009119580 A	2009.06.04