



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.09.2017 Bulletin 2017/37

(51) Int Cl.:
B66C 9/18 (2006.01) **B66C 7/00 (2006.01)**
B66C 7/10 (2006.01)

(21) Application number: **16159283.7**

(22) Date of filing: **08.03.2016**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **MÖYKKYMÄKI, Kari**
00510 HELSINKI (FI)
• **LEMPIÄINEN, Petteri**
01600 VANTAA (FI)
• **SULKAMA, Mikko**
02250 ESPOO (FI)

(71) Applicant: **Erikkila Oy**
02430 Masala (FI)

(74) Representative: **Berggren Oy, Helsinki & Oulu**
P.O. Box 16
Eteläinen Rautatiekatu 10A
00101 Helsinki (FI)

(54) **A LOCKING ARRANGEMENT FOR CRANE BRIDGES AND A TELESCOPIC CRANE USING THE SAME**

(57) Locking arrangement for removably locking at least one trolley (104) to a counterpart arranged to a girder (102) being a part of a crane bridge. The at least one trolley is arranged to travel along the girder. The locking arrangement comprises at least one magnet (114) and at least one receiving area made of a material that is attracted to the at least one magnet. The at least one

magnet is arranged to one of the following: at least one trolley; counterpart, and the other one of the following: at least one trolley; counterpart, comprising the at least one receiving area at a location corresponding to the at least one magnet. The invention also relates to a crane bridge comprising at least one locking arrangement.

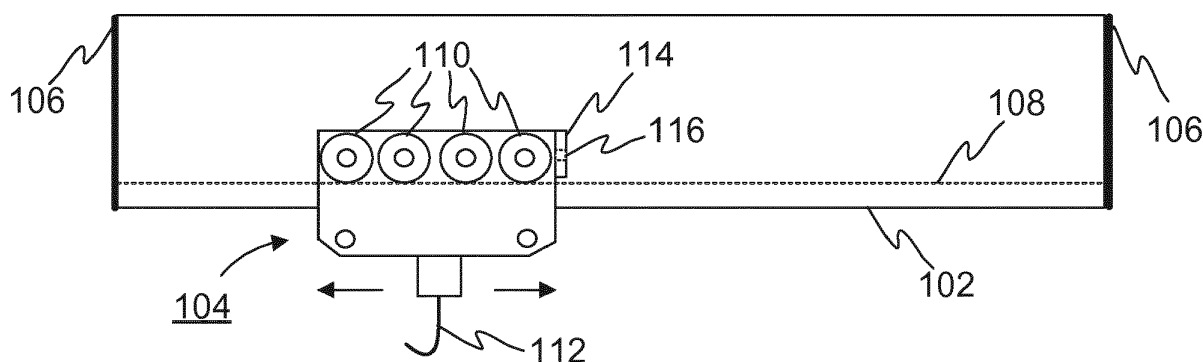


FIG. 1

Description

TECHNICAL FIELD

[0001] The invention concerns in general the technical field of crane systems. Especially the invention concerns safety solution for crane bridges.

BACKGROUND

[0002] Traditionally crane bridges are manufactured of crane elements coupled together in some known manner. The crane elements, also known as crane profiles, are traditionally manufactured of iron, which has provided hard enough structure in order to meet the challenges in lifting heavy objects. Typically in crane systems a trolley is arranged to travel along the crane profile.

[0003] In some cases the crane bridge may not be possible to be made sufficient long, for example because buildings, poles of a buildings or other machines may limit the usable area of the crane. One option in that kind of cases may be a telescopic crane bridge. In the telescopic crane bridge a telescopic profile is suspended from a crane bridge profile typically by means of a trolley and the telescopic profile is arranged to travel at least partly outside the travel range of the crane bridge profile. Thus, the total length of the crane bridge profile may be at least partly increased or decreased. Furthermore, the operational area of the crane bridge may be extended, at least partly.

[0004] When the crane bridge is moving along a track, also the trolley may move unintentionally along the crane bridge profile, if the telescope profile is not locked to the crane bridge profile. Furthermore, in a telescopic crane bridge also the telescope profile may travel unintentionally at least partly outside the crane bridge profile, when the crane bridge is moving. If the telescope profile moves outside the travel range of the crane bridge profile, while the crane bridge is moving, the telescope profile may cause a dangerous situation by colliding to an obstacle, such as building, pole of a building or other machines. The collision may further cause damages to the crane system and in the obstacle to which the telescope profile collides and causes costs in a form of repairing costs but also in the form of downtime of the system. Moreover, the collision may cause personal injuries to personnel operating the system or to bystanders.

[0005] According to one prior art solution the trolley may include an additional element to open and close a mechanical lock used to lock the trolley to the crane bridge profile. One drawback of the prior art solution is the complexity of the solution. Furthermore, the prior art solution includes wear-out components and the mechanical solution may keep disturbing noise.

[0006] Thus, there is continuous need for improving the safety in crane systems.

SUMMARY

[0007] An objective of the invention is to present a locking arrangement for removably locking at least one trolley to a counterpart arranged to a girder being a part of a crane bridge. Another objective of the invention is to present a telescopic crane comprising at least one locking arrangement. Another objective of the invention is that the locking solution improves the safety in crane systems.

[0008] The objectives of the invention are reached by a locking arrangement and a telescopic crane as defined by the respective independent claims.

[0009] According to a first aspect, a locking arrangement for removably locking at least one trolley to a counterpart arranged to a girder being a part of a crane bridge is provided, the at least one trolley is arranged to travel along the girder, wherein the locking arrangement comprises at least one magnet and at least one receiving area made of a material that is attracted to the at least one magnet, the at least one magnet is arranged to one of the following: at least one trolley; counterpart, and the other one of the following: at least one trolley; counterpart, comprising the at least one receiving area at a location corresponding to the at least one magnet.

[0010] The at least one magnet may be arranged fixedly with at least one fastening means, wherein the at least one fastening means may be at least one of the following: screw, bolt, glue, bracket fastening.

[0011] Alternatively, the at least one magnet may arranged floatingly so that the at least one magnet may be configured to be caught by one of the following: receiving area of the at least one trolley, receiving area of the counterpart. In addition the locking arrangement may comprise a socket arranged to at least one of the following: receiving area of the at least one trolley, receiving area of the counterpart; the socket may be configured to align the at least one magnet to the receiving area.

[0012] The at least one magnet may be one of the following: permanent magnet, electromagnet.

[0013] Alternatively or in addition, the at least one receiving area may be a second magnet that is arranged so that the pole of the at least one magnet and the pole of the second magnet facing to each other are opposite poles.

[0014] The counterpart may be at least one of the following: end plate of the girder, a separate element fixed to the girder.

[0015] According to a second aspect, a telescopic crane is provided, wherein the telescopic crane comprising: a girder with at least one counterpart, wherein the girder is a part of a crane bridge; at least one trolley arranged to travel along the girder; and a telescope girder suspended from the girder by means of the at least one trolley, wherein the telescopic crane comprising at least one locking arrangement as defined above in order to lock the at least one trolley to a counterpart arranged to the girder.

[0016] The telescopic crane may be implemented so that the counterpart is arranged to the girder so that it is positioned between two trolleys.

[0017] The exemplary embodiments of the invention presented in this patent application are not to be interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" is used in this patent application as an open limitation that does not exclude the existence of also un-recited features. The features recited in depending claims are mutually freely combinable unless otherwise explicitly stated.

[0018] The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objectives and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF FIGURES

[0019] The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings.

Figure 1 illustrates an example of an implementation of the locking arrangement according to the invention.

Figures 2A-2C illustrate example of an implementation of the fastening means for the locking arrangement according to the invention.

Figure 3 illustrates another example of an implementation of the locking arrangement according to the invention.

Figure 4A-4B illustrate another example of an implementation of the locking arrangement according to the invention.

Figure 5 illustrates a further example of an implementation of the locking arrangement according to the invention.

DESCRIPTION OF SOME EMBODIMENTS

[0020] Figure 1 illustrates an example of a crane bridge profile in which the solution according to an example of the invention may be implemented. In the following detailed description it is used a term girder 102 in order to refer to crane bridge profile for emphasizing that the referred part in the crane system is the one along which a trolley 104 travels. The girder 102 may be manufactured of iron, for example, which provides hard enough structure in order to meet the challenges in lifting heavy objects. The trolley 104 may comprise a body part into which

a number of rolls 110 are fastened through a shaft. The sizes of the rolls 110, as well as material of the rolls 110, are advantageously adjusted to the size of a runway 108 advantageously so that the rolling resistance is minimized. A hoist 112 may be configured to be fastened in the trolley 104 through the shaft.

[0021] In typical implementations of the crane bridge end plates 106 may be arranged to the girder 102. The purpose of the end plates 106 is to limit the movement of the trolley 104, but also to protect the runway 108 against dirt. Further, the end plates 106 also increase strength of the structure in general. The end plates 106 may be fastened with the girder 102 with known fastening means, such as bolts, screws or similar.

[0022] Fundamentally, a locking arrangement according to the invention may be used to lock the trolley 104 removably to a counterpart arranged to the girder 102, so that the trolley 104 may be released from the counterpart. The locking arrangement according to the present invention may be utilized with different types of cranes in which there is need to lock at least one trolley to a counterpart in order to lock the crane structure at least partly. Especially, the present invention may be used in connection with telescopic crane system, as will be described. The idea is based on a utilization of one or more magnets in the locking arrangement that couple removably to an element being at least part of the counterpart.

[0023] Next the invention is described in an implementation as illustrated in Figure 1, wherein the counterpart is an end plate 106 of the girder 102. The locking arrangement according to the invention comprises at least one magnet 114 and at least one receiving area. The at least one magnet 114 may be at least one of the following: permanent magnet, electromagnet. The electromagnet may be provided from a coil of wire, for example. When an electric current is configured to flow through the coil, the coil acts as a magnet. The strength of the magnet may preferably be 4 to 6 times the force needed to move the trolley 104, when it is not locked. The at least one receiving area is made of a material that is attracted to the at least one magnet 114. The material of the at least one receiving area may be a ferromagnetic material, such as iron, nickel, cobalt, or alloys of them, for example. The receiving area may also be formed with a second magnet. In such an implementation the pole of the at least one magnet and the pole of the second magnet facing to each other are opposite poles.

[0024] The at least one magnet 114 may be arranged to at least one of the following: trolley 104, end plate 106 of the girder 102; and the other one comprises the receiving area at a location corresponding to the at least one magnet 114. In case of the trolley 104 the at least one magnet 114 or the at least one receiving area may preferably be arranged to the surface of the trolley 104 facing to the end plate 106 of the girder 102 in which the trolley 104 may be removably locked. The at least one magnet 114 may be fixedly fastened to the trolley and/or

to the end plate 106 of the girder 102 by means of at least one fastening means 116. The at least one fastening means 116 may be, for example, at least one of the following: screw, bolt, glue, bracket fastening.

[0025] Figures 2A to 2C illustrate some examples of the fastening means 116 which may be used to fasten the at least one magnet 114 to the trolley 104. The trolley 104 is used only as an example to which the magnet 114 may be fastened, but the magnet 114 may also be fastened to the end plate 106 of the girder 102 with the at least one fastening means 116, as well. In Figure 2A the magnet 114 is fastened to the trolley 104 with a screw, bolt or similar 116a. In Figure 2B the magnet 114 is fastened to the trolley 104 with glue 116b. In Figure 2C the magnet 114 is fastened to the trolley 104 via a bracket 116c. The bracket 116c may be fastened to the trolley 104 and to the magnet 114 with one or more screw, bolt or similar 116a, for example.

[0026] Figure 3 illustrates as an example an implementation of a locking arrangement according to the invention. The trolley 104 is locked, in this example, to the end plate 106 of the girder 102 by means of the locking arrangement according to the invention. The magnet 114 may be fixedly fastened to the trolley with at least one fastening means 116 and the end plate of the girder 102 may comprise the receiving area (referred by RA in Figure 3) for the magnet 114 at a location corresponding to the magnet 114. Alternatively, the magnet 114 may be fixedly fastened to the end plate 106 of the girder 102 and the trolley 104 may comprise the receiving area for the magnet 114 at a location corresponding to the magnet 114. When the trolley 104 is arranged to travel to the end of the girder 102, the receiving area and the magnet 114 attract each other so that the magnet 114 and the receiving area fasten to each other in order to lock the trolley 104 to the end plate 106 of the girder 102. In order to unlock the trolley from the locking position it may be instructed to travel away from the end plate 106 of the girder 102 causing the magnet 114 and the receiving area to separate from each other, and thus to release the trolley 104 to move freely in the girder 102

[0027] Alternatively or in addition, the magnet may be used to lock the trolley to the end plate 106 of the girder 102 so that the magnet 114 is not fixedly fastened neither on the trolley 104 nor the girder 102. In the other words, the at least one magnet 114 may also be arranged floatingly so that the at least one magnet is configured to be caught by one of the following: receiving area of the at least one trolley 104, receiving area of end plate 106 of the girder 102. Thus, when the trolley 104 is configured to be released to move freely in the girder 102, the magnet 114 may be configured to be caught by the receiving area of the trolley 104 or the receiving area of the end plate 106 of the girder 102. The locking arrangement according to the invention may also comprise a socket arranged to the receiving area of at least one of the following: trolley 104 or end plate 106 of the girder 102, for aligning the magnet 114 to the receiving area in a case that the at

least one magnet 114 is arranged floatingly. Moreover, the socket enables, at least partly, holding the magnet in a desired position. The socket is made of a material that is attracted to the at least one magnet 114. The material of the socket may be a ferromagnetic material, such as iron, nickel, cobalt, or alloys of them, for example.

[0028] The locking arrangement according to the invention may be implemented at least at one end of the girder 102 and the trolley 104 in order to lock the trolley 104 to at least one end plate 106 of the girder 102. So far in the description the locking arrangement is implemented only in one end of the girder 102 and trolley 104. However, the locking arrangement according to the invention may also be implemented at the both ends of the girder 102 and the trolley 104 in order to lock the trolley 104 to one of the end plates 106 according to need.

[0029] Above it is described example embodiments of the locking arrangement according to the invention, wherein the locking arrangement is implemented in a single crane bridge structure. Preferably, the locking arrangement described above may be implemented in a telescopic crane system. In a telescopic crane arrangement a telescope bridge profile suspended from a crane bridge may be arranged to travel at least partly outside the travel range of the crane bridge. Thus, the total length of the crane bridge may be at least partly increased or decreased and the operational area of the crane bridge may be extended, at least partly.

[0030] Figures 4A and 4B illustrates an example of a telescopic crane bridge in which the locking arrangement according to the invention described earlier may be implemented. In the following detailed description it is used a term telescope girder 402 in order to refer to telescope profile for emphasizing that the referred part in the telescopic crane bridge is the one that is suspended from the crane bridge profile, i.e. girder 102 as defined earlier. For sake of clarity any trolley arranged to travel along the telescope girder 402 is called as telescope trolley in the following description. The telescope girder 402 may be suspended from the girder 102 by means of at least one crane trolley 404a that is the at least one trolley arranged to travel along the girder 102. The at least one crane trolley 404a may be fastened to the telescope girder 402 with known means, such as bolts, screws or similar. A telescope trolley 404b may be arranged to travel along the runway 408 arranged within the telescope girder 402. A hoist 112 may be configured to be fastened in the telescope trolley 404b through a shaft. The at least one crane trolley 404a may be similar to the trolley 104 described earlier and depending an implementation the number of trolleys may vary, e.g. being e.g. two in the telescopic crane bridge systems. Alternatively or in addition, the telescope trolley 404b may be similar to the trolley 104 described earlier. The at least one crane trolley 404a may be arranged to travel along the girder 102 in both directions, so that the telescope girder 402 suspended from the girder 102 by means of the at least one crane trolley 404a may travel at least partly outside the

travel range of the crane bridge at least in one direction. Figure 4A illustrates the telescopic crane bridge in a first position, wherein the telescope girder 402 is in a closed position. In the closed position the telescope girder 402 is pulled in. Figure 4B illustrates the telescopic crane bridge in a second position, wherein the telescope girder 402 is in an open position. In the open position the telescope girder 402 is partly pulled out.

[0031] The above described locking arrangement according to the invention may be implemented at least in one end of the girder 102 and in the corresponding outer end of the at least one crane trolley 404a facing to the end plate 106 of the girder 102 in order to lock the at least one crane trolley 404a removably to the at least one end plate 106 of the girder 102. If the telescope girder 402 is suspended from the girder 102 by means of two or more crane trolleys 404a, the locking arrangement according to the invention may be implemented at least in one end of the girder 102 and in the outer end of the crane trolley 404a closest to the at least one end of the girder 102 to which the locking arrangement may be implemented. Alternatively, it may be arranged so that one or more counterparts are mounted in between two trolleys and the locking is arranged with either one of the trolleys wherein the magnet - counterpart arrangement is implemented.

[0032] Further, the above described locking arrangement according to the invention may be implemented at least in one end of the telescope girder 402 and in the corresponding end of the telescope trolley 404b facing to the end plate 406 of the telescope girder 402 in order to lock the telescope trolley 404b removably to the at least one end plate 406 of the telescope girder 402.

[0033] Figure 5 illustrates schematically a further example of a telescopic crane bridge in which the locking arrangement according to the invention is implemented. In the example of Figure 5 the telescopic crane bridge is such that a telescope girder 402 is arranged and thus enabled to travel in both directions, i.e. extending over the girder 102 ends at both ends according to need. The telescope girder 402 is movably mounted to the girder 102 with two trolleys 404a, wherein the telescope girder 402 is fixed with the trolleys with known fastening means, such as screws, bolts or similar. The mutual distance of the trolleys 404a is, according to an example of the invention, such that it enables the movement of the telescope girder 402 to both directions a distance needed in the implementation. In the example of the invention as illustrated in Figure 5 the counterpart 502 is arranged between the trolleys and the counterpart is fixed to the girder 102 with known fixing means, such as screws, bolts or similar. The counterpart, according to this example, is positioned so that both trolleys may be locked to it, one at a time, with the locking arrangement according to the invention. The trolley 404a in question is locked when the telescope girder 402 is moved, or extended. As discussed earlier either the trolley or the counterpart may comprise the one or more magnets and in the other part it is arranged the receiving area. In the example of Figure

5 the number of counterparts is one, but the number of counterparts may vary. For example, there may be arranged one counterpart for each trolley. Preferably, the counterparts are arranged and fixed to the girder 102 so that they do not limit the extension of the telescope crane bridge in any direction. A further remark is to be made to telescope trolley 404b which is equipped with magnet 114 - counterpart pair on both sides of the trolley. This enables locking the telescope trolley 404b on both sides e.g. to the corresponding end plates of the telescope girder 402. This also enables the controlling of the telescopic crane system in a better and safer way because it allows the locking of trolleys with counterparts in a sophisticated way.

[0034] The present invention as hereby described provides great advantages over the prior art solutions. The locking arrangement according to the invention enables that the at least one trolley 102, 404a, 404b may be locked to the counterpart, being a separate element or the end plate 106, 406 of the girder 102, 402, while the crane bridge is configured to move. Thus, the locking arrangement according to the invention improves at least partly the safety in crane system. Furthermore, the locking arrangement according to the invention enables that the telescope girder 402 is not allowed to travel outside the travel range of the girder 102, while the crane bridge is configured to move. Thus, the locking arrangement according to the invention improves at least partly the safety in crane systems. Another advantage that the present invention provides is that the telescope girder 402 may be configured to travel from the open position to the closed position so that the telescope trolley 404b is locked to the counterpart, such as an end plate 406, of the telescope girder 402 that locates further away from the girder 102. When the telescope girder 402 arrives to the closed position, the crane trolley 404a is configured to be locked to the counterpart, such as the end plate 106 of the girder 102 as shown in Figure 4A. After that the telescope trolley 404b may be instructed to move away from the counterpart, such as an end plate 406 of the telescope girder 402 causing the magnet 114 and the receiving area to separate from each other, and thus to release the telescope trolley 404b to move freely in the telescope girder 402. Without locking the telescope trolley 404b to the counterpart, such as the end plate of the 406 of the telescope girder 402, that locates further away from the girder 102, the telescope trolley 404b should be configured to travel to the end of the telescope girder 402 that locates closer to the girder 102 before the telescope girder 402 may be configured to travel from the open position to the closed position. Thus, the locking arrangement according to the invention at least partly makes the use of the crane easier. Moreover, the locking arrangement according to the present invention is very simple and comprises only few parts and the parts have a good wear tolerance.

[0035] As is explicitly disclosed above the receiving area may be implemented either to at least one counter-

part, such as an end plate of a girder, or to at least one end of at least one trolley traveling along the girder. The receiving area itself may be a specific area in at least one of the mentioned entities or it may be implemented with a separate part fastened to at least one of the mentioned entities.

[0036] As already disclosed above the invention is mainly described in an implementation, wherein the counterpart is an end plate of the girder. However, the counterpart may also be a separate part, or element, arranged to be fixed to the girder, or even to a telescope girder 402. The fixing position may be determined according to the crane implementation. The counterpart is made of material that interacts, at least within the at least one receiving area, with the magnet so that the removable locking is achieved, as described. The invention does not take any standpoint on an entity into which the magnet is to be arranged and on an entity into which the receiving area is arranged. This becomes clear from the description and the related figures.

[0037] The specific examples provided in the description given above should not be construed as limiting the applicability and/or the interpretation of the appended claims. Lists and groups of examples provided in the description given above are not exhaustive unless otherwise explicitly stated.

Claims

1. A locking arrangement for removably locking at least one trolley to a counterpart arranged to a girder being a part of a crane bridge, the at least one trolley is arranged to travel along the girder, wherein the locking arrangement comprises at least one magnet and at least one receiving area made of a material that is attracted to the at least one magnet, the at least one magnet is arranged to one of the following: at least one trolley; counterpart, and the other one of the following: at least one trolley; counterpart comprising the at least one receiving area at a location corresponding to the at least one magnet.
2. The locking arrangement according to claim 1, wherein the at least one magnet is arranged fixedly with at least one fastening means.
3. The locking arrangement according to claim 2, wherein the at least one fastening means is at least one of the following: screw, bolt, glue, bracket fastening.
4. The locking arrangement according to claim 1, wherein the at least one magnet is arranged floatingly so that the at least one magnet is configured to be caught by one of the following:
 - receiving area of the at least one trolley,
 - receiving area of the counterpart.
5. The locking arrangement according to claim 4, wherein the locking arrangement comprises a socket arranged to at least one of the following:
 - receiving area of the at least one trolley,
 - receiving area of the counterpart,
 the socket is configured to align the at least one magnet to the receiving area.
6. The locking arrangement according to any of the preceding claims, wherein the at least one magnet is one of the following: permanent magnet, electro-magnet.
7. The locking arrangement according to any of the preceding claims, wherein the at least one receiving area is a second magnet that is arranged so that the pole of the at least one magnet and the pole of the second magnet facing to each other are opposite poles.
8. The locking arrangement according to any of the preceding claims, wherein the counterpart is at least one of the following: end plate of the girder, a separate element fixed to the girder.
9. A telescopic crane comprising:
 - a girder with at least one counterpart, wherein the girder is a part of a crane bridge,
 - at least one trolley arranged to travel along the girder, and
 - a telescope girder suspended from the girder by means of the at least one trolley,
 wherein the telescopic crane comprising at least one locking arrangement according to any of the preceding claims in order to lock the at least one trolley to a counterpart arranged to the girder.
10. The telescopic crane according to claim 9, wherein the counterpart is arranged to the girder so that it is positioned between two trolleys.

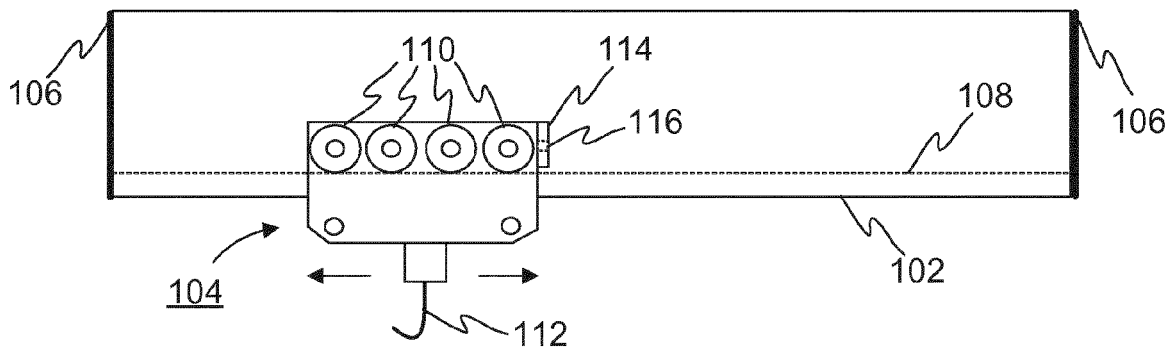


FIG. 1

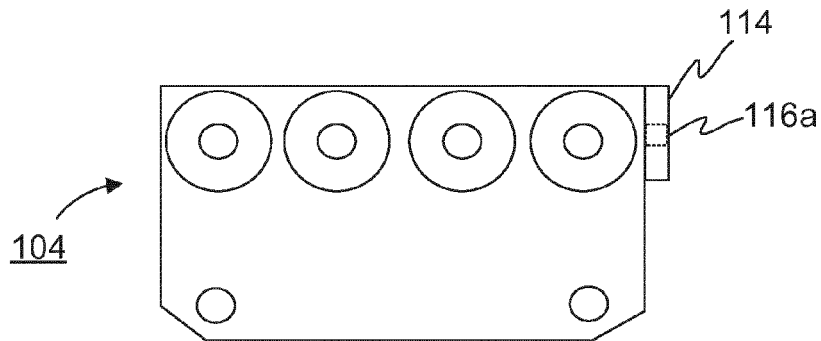


FIG. 2A

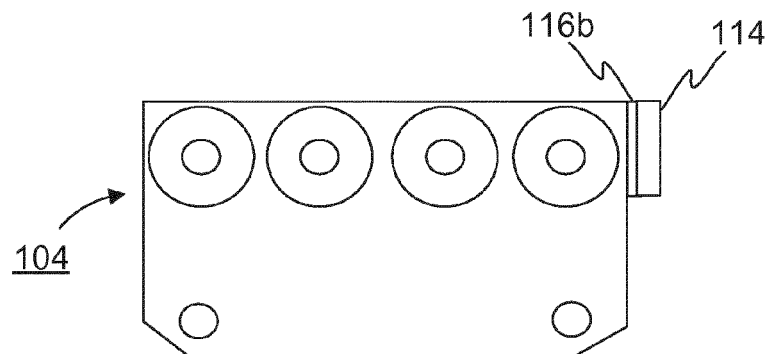


FIG. 2B

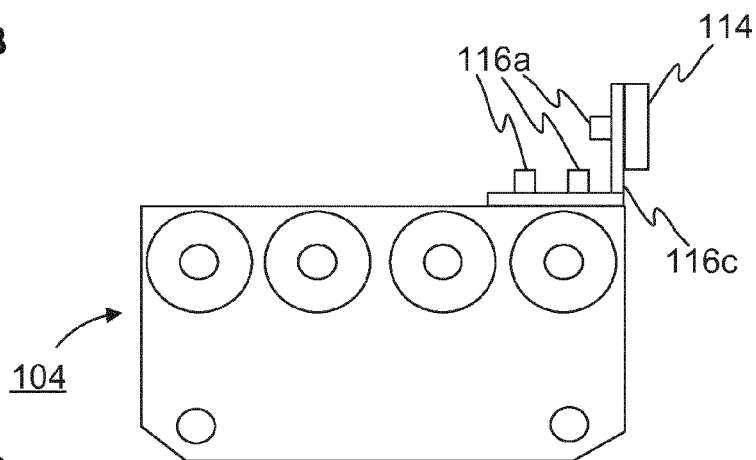


FIG. 2C

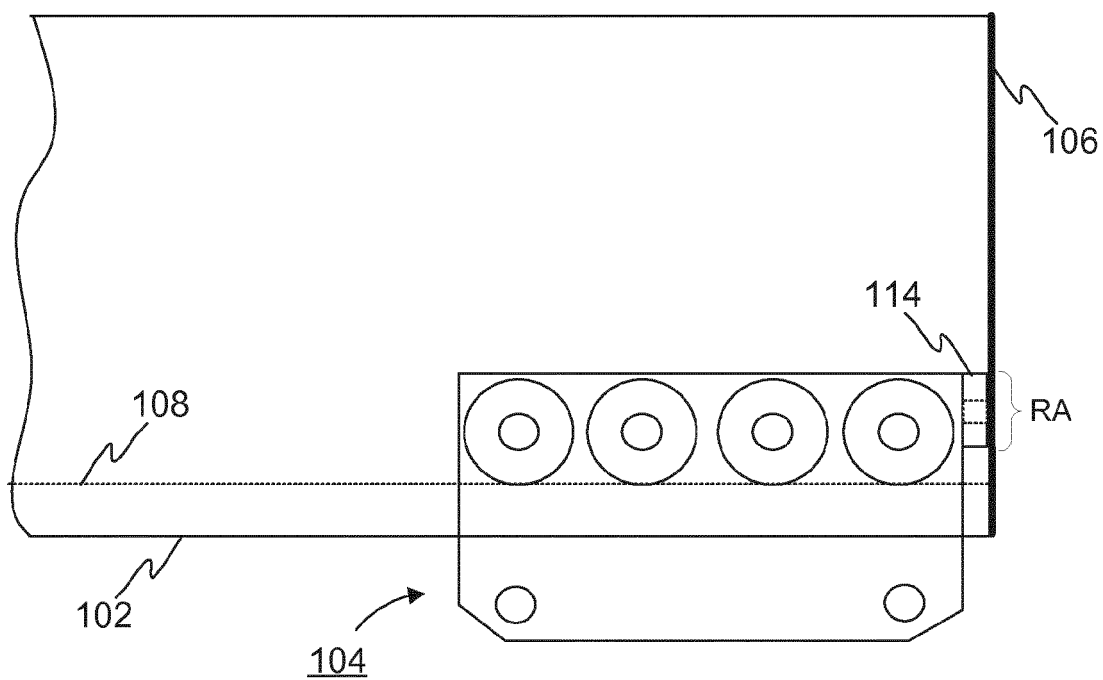


FIG. 3

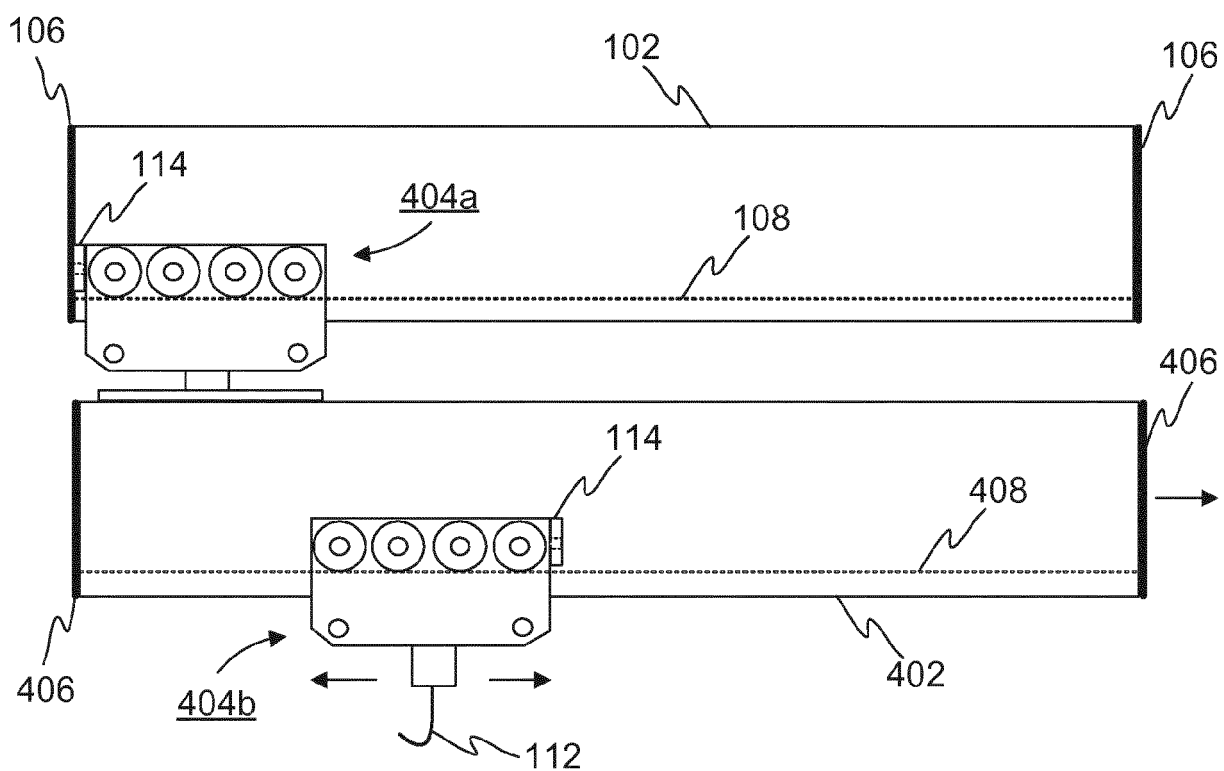
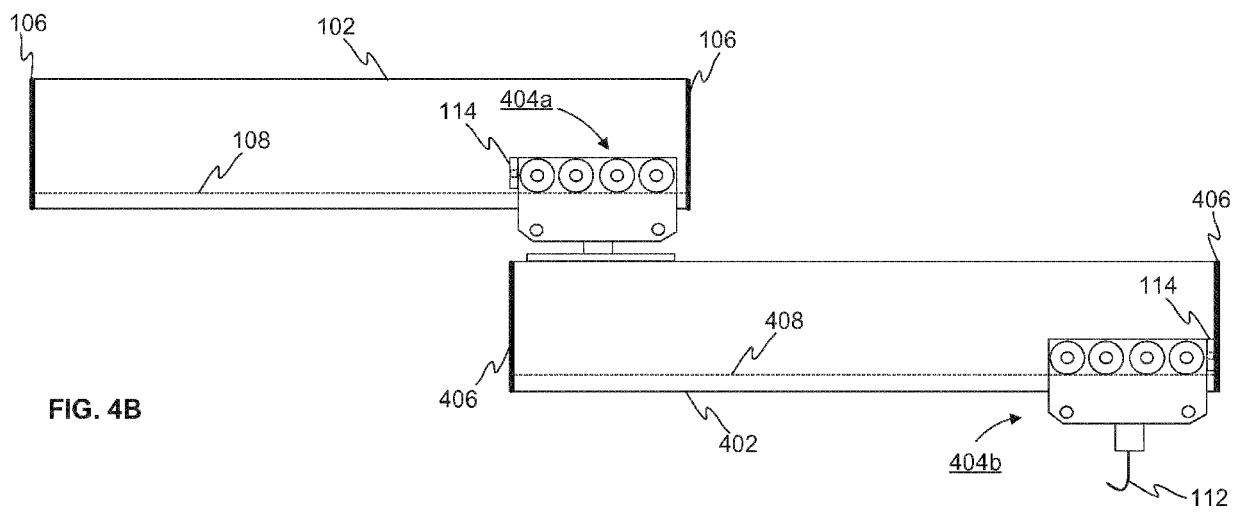


FIG. 4A



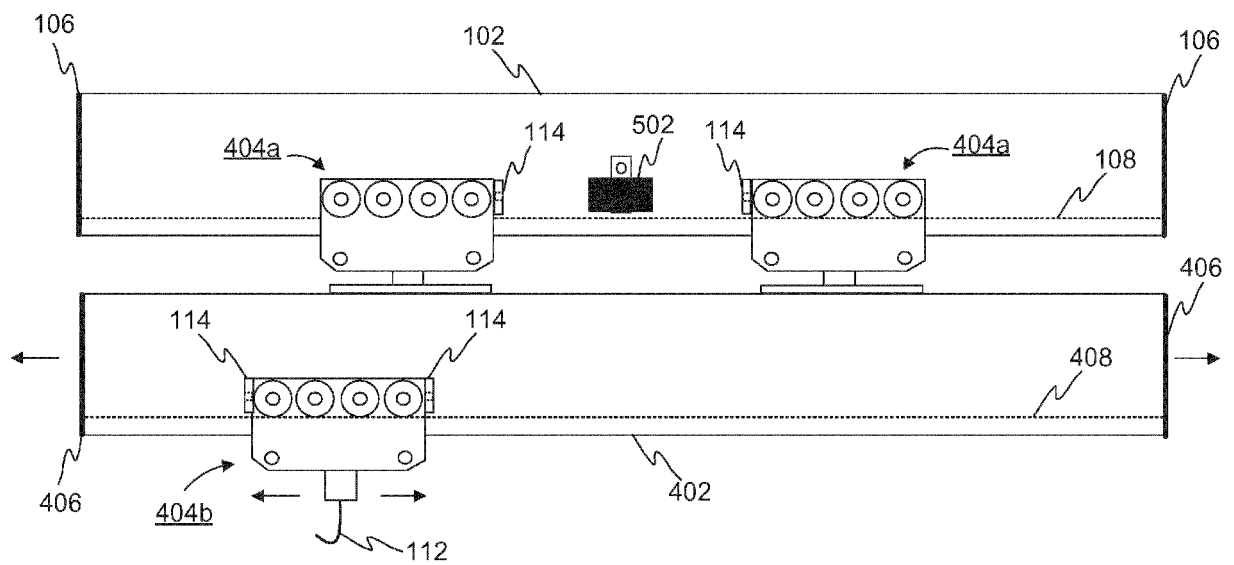


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 16 15 9283

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2005 187155 A (KITO KK) 14 July 2005 (2005-07-14) * abstract; figures 1,9 * * online translation; paragraphs [0022], [0029] * -----	1-3,6,8,9	INV. B66C9/18 B66C7/00 B66C7/10
A	WO 2006/028994 A2 (MHE TECHNOLOGIES INC [US]; WAISANEN STEVEN K [US]) 16 March 2006 (2006-03-16) * abstract; figure 2 * -----	1,9	
A	WO 2007/018487 A2 (MHE TECHNOLOGIES INC [US]; WAISANEN STEVEN K [US]) 15 February 2007 (2007-02-15) * figure 1 * -----	1,9	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66C B66F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 September 2016	Examiner Verheul, Omiros
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 15 9283

5 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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-09-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005187155 A	14-07-2005	NONE	
WO 2006028994 A2	16-03-2006	US 2008251485 A1 WO 2006028994 A2	16-10-2008 16-03-2006
WO 2007018487 A2	15-02-2007	AT 528248 T CA 2615871 A1 EP 1910210 A2 US 2009159548 A1 WO 2007018487 A2	15-10-2011 15-02-2007 16-04-2008 25-06-2009 15-02-2007