(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 964 471 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.03.2022 Bulletin 2022/10

(21) Application number: **20386042.4**

(22) Date of filing: **02.09.2020**

(51) International Patent Classification (IPC):
B66B 19/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66B 19/00

(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:
KH MA MD TN

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(54) **METHOD FOR ASSISTED INSTALLATION**

(57) This is an invention that refers to a method of installing an elevator or any other similar lifting mechanism. It consists of a modular and self-standing platform, that assists recording the dimensions and the details of the shaft through a CMM system. The collected data from the CMM can be transferred to an augmented reality (AR) system. This system processes the data acquired from the CMM and combines them with information of system components. The output of this processing is forwarded to AR system, which will point out to the user the right way of installing each component in the construction.

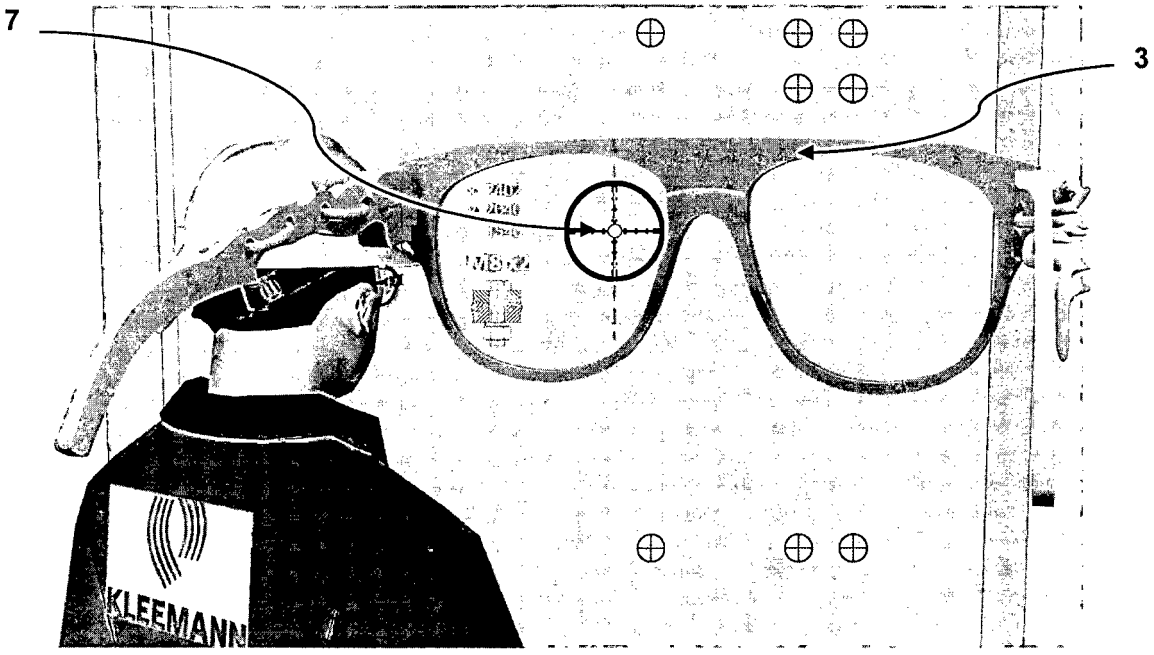

Figure 2.

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Description

[0001] Present invention refers to method of installing an elevator, or any other similar lifting mechanism, by using an augmented reality (AR) system. The dimensions and all required details from a shaft are recorded through a coordinate measuring machine (CMM), which is placed on a built-in platform, and finally the collected data are transferred to an AR system that is used from the installers. Following are described further details about the invention.

[0002] Millions of elevators are installed everyday around the world, since it is the most widely used way of vertical transportation that moves people or/and goods between floors of a building. Installing an elevator takes several days of work, depending the dimensions of the shaft and the specific features of each construction.

[0003] According to the state of the art, the elevator is installed into the shaft by using a scaffold which is previously installed in the shaft. Moreover, temporary platforms are arranged in order to assist the installers to place the several components, such as brackets on the walls or even the elevator machine on the top of the shaft. The dimensions, and perhaps special details, of the shaft are recorded through conventional methods, such as measuring tape and plump lines, and also these methods are used during the installation.

[0004] The main drawback of this method is the demanded time for installing and uninstalling the scaffold. Furthermore, each shaft is described by different specifications. It is crucial knowing not only the dimensions of the shaft, but also specific features such as abnormalities on the walls. It is common the walls of the shaft not being perfect vertical levels through the whole height. Moreover, there are cases that the relevant distance of the door opening and the opposite wall is not the same between the different floors of the building, this situation causes several issues while installing the elevator since it is difficult to match the cabin door and the floor door through the whole travelling distance. Last but not least, the installers spend a lot of time measuring with tapes and it also takes quite a time to ensure that parts of the installation, such as the guide rails, are installed correctly.

[0005] The presented invention is a method assisting the installation. The first part of the presented invention concerns the built-in platform and aims on eliminating the difficulties that the installers face. The scope of the second part, of using the CMM on the platform, is presenting an easy way of recording precisely the shaft, so the afterwards installation demands less effort. Finally, an AR system is used and the collected data, from the CMM, are processed and transformed into information for the installer.

[0006] In Figure 1 is presented the construction that is used. In detail, the built-in platform (1) can be placed in any level of the building, but it is useful the fact that it can be placed on the upper floor level, so the moving carrier goes through the whole shaft. The hoist mechanism (5) and the pulley system (6) are responsible for the movement of the platform. The CMM (2) is placed on the carrosserie and is secured, so it remains still, concerning the carrosserie as the corresponding reference point. The moving carrier starts going down with CMM machine on it and the shaft is scanned. An additional sensor coupled with the CMM can be placed in any fixed position in the shaft. The purpose of this additional sensor is to provide corrections in data regarding the position of CMM, since the CMM may be subjected to disturbances (sudden lateral movements, obstacles) beyond the range that CMM software can handle.

[0007] The collected data from the CMM can be transferred to an augmented reality (AR) system (3), this system processes the data acquired from the CMM and combines them with information (drawing data) of system components. The output of this processing is forwarded to AR system, which will point out to the user the right way of installing each component in the construction. AR is an interactive experience of a real-world environment, in our case the shaft (4), where the objects that reside in the real world are enhanced by computer-generated perceptual information. The overlaid sensory information, such as the coordinates of a screw on the wall (7), are additive to the natural environment. Measuring tapes and plump lines can be used as supplementary auxiliaries during installation, but the AR (3) may stand by itself as the only device that the installer uses. As is shown in in Figure 2 the AR system may be a pair of glasses that the installer is able to wear during the installation.

[0008] In Figure 3 are presented the abovementioned steps. The method is described briefly by this way. Firstly, the CMM scans the shaft and then these coordination data are processed and stored. The data are grouped according to the needs of the installer. The acquired information is finally projected to the AR apparatus. These data are used from the installer as a virtual installation manual, but the details are more specific and it is handier.

[0009] Finally, Figures 4 and 5 are presenting an example of the invention in action. Figure 4 represents an installation where the installer is able to use real tools (8), such as gloves and measuring tape, and combines them with the AR parts that are presented through the AR system in the room. The presented guide rail (9), even if it seems real, is actually an AR part. Figure 5 reveals the way the installer sees the room with real and AR parts, through the AR apparatus.

Claims

1. The "Method for assisted installation" is **characterized in that** on a modular and self-standing platform, that assists recording the dimensions and the details of the shaft through a CMM, the recorded data are manipulated in a way that are used by an augmented reality (AR) system that assists the afterward installation of an elevator or any other similar lifting mech-

anism.

2. The invention according to Claim 1, is **characterized in that** the overlaid sensory information, such as the coordinates of a screw on the wall, are additive to the natural environment.

3. The invention according to Claim 1-2, is **characterized in that** measuring tapes and plump lines can be used as supplementary auxiliaries during installation, but the AR system may stand by itself as the only device that the installer uses.

4. The invention according to Claim 1-3, is **characterized in that** the AR system looks like a pair of glasses, or a similar apparatus, that the installer is able to wear during the installation.

5. The invention according to Claim 1-4, is **characterized in that** it is an alternative installation manual.

6. The invention according to Claim 1, is **characterized in that** an additional sensor coupled with the CMM can be placed in any fixed position in the shaft to provide corrections in data regarding the position of CMM, in case of disturbances beyond the range that CMM software can handle.

7. The invention according to Claim 1 and 6, is **characterized in that** the CMM scans the shaft during descend movement, with a continuous and interrupted way, from top to bottom.

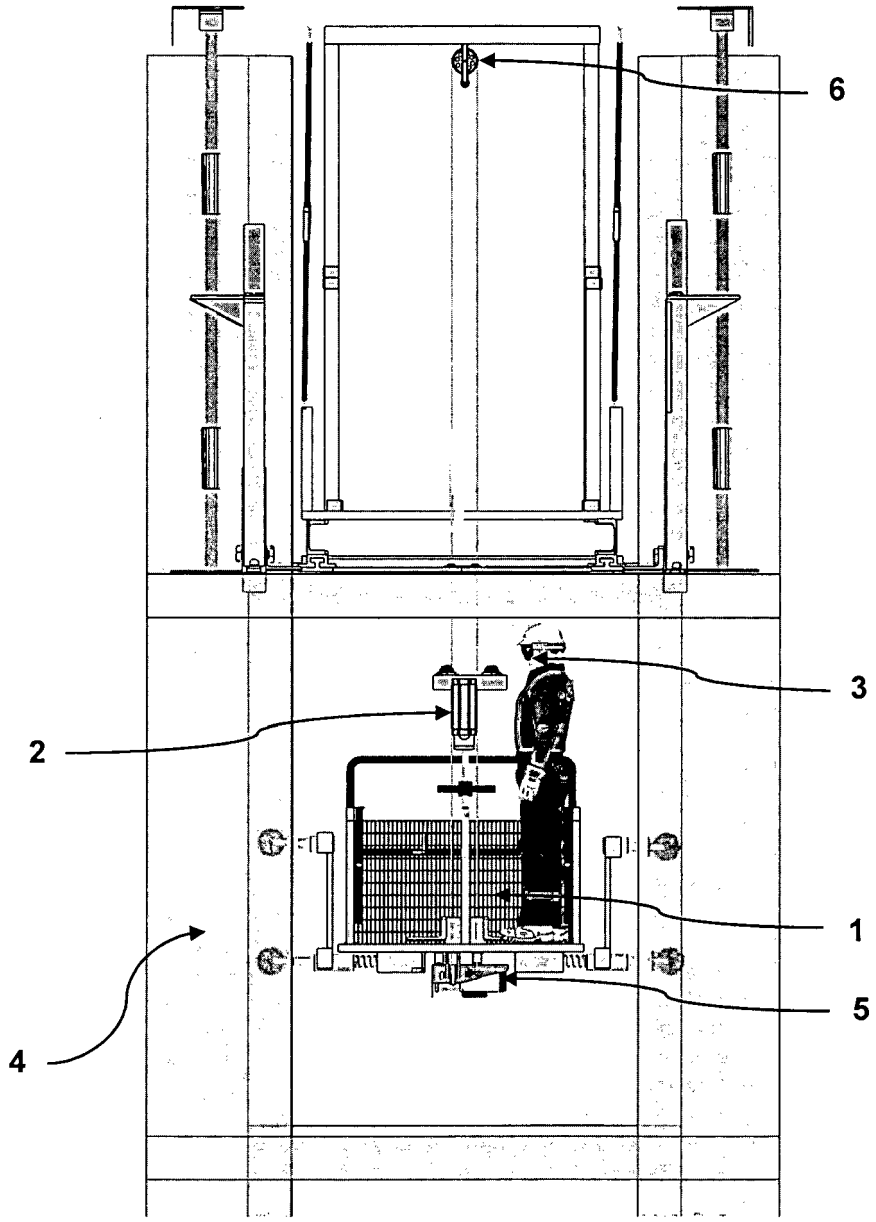

Figure 1.

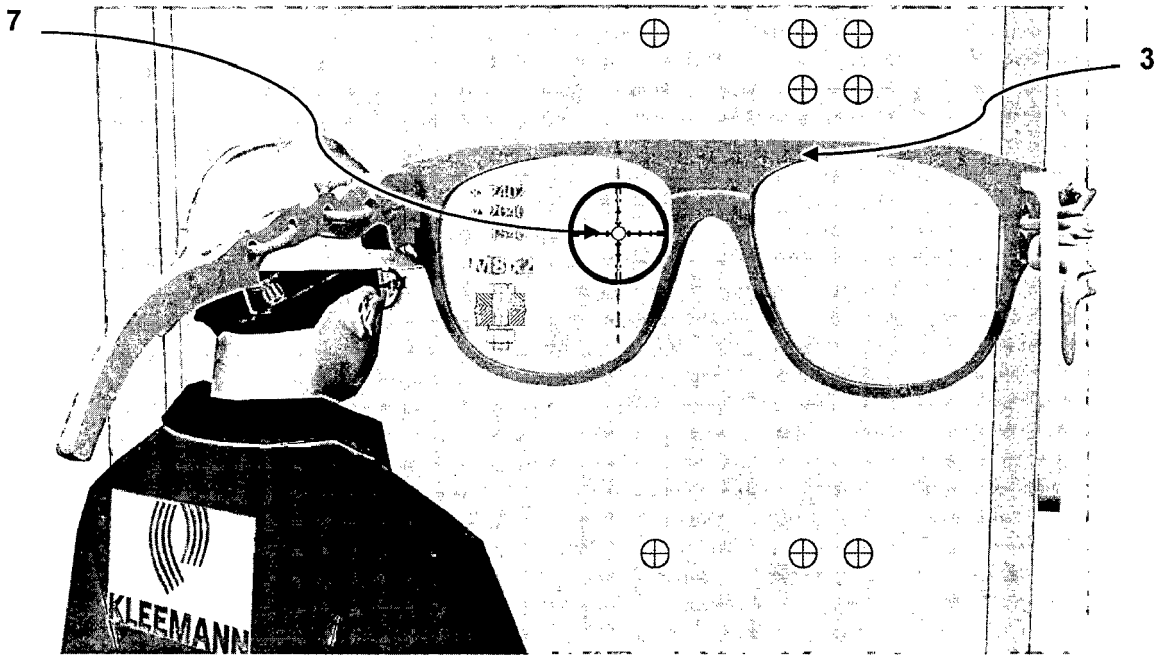

Figure 2.

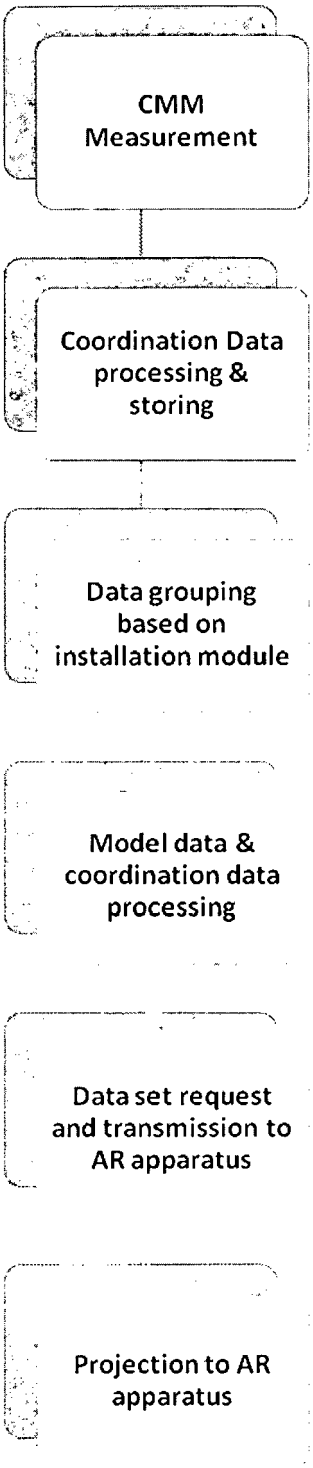
CMM Measurement
Coordination Data processing & storing
Data grouping based on installation module
Model data & coordination data processing
Data set request and transmission to AR apparatus
Projection to AR apparatus

Figure 3.

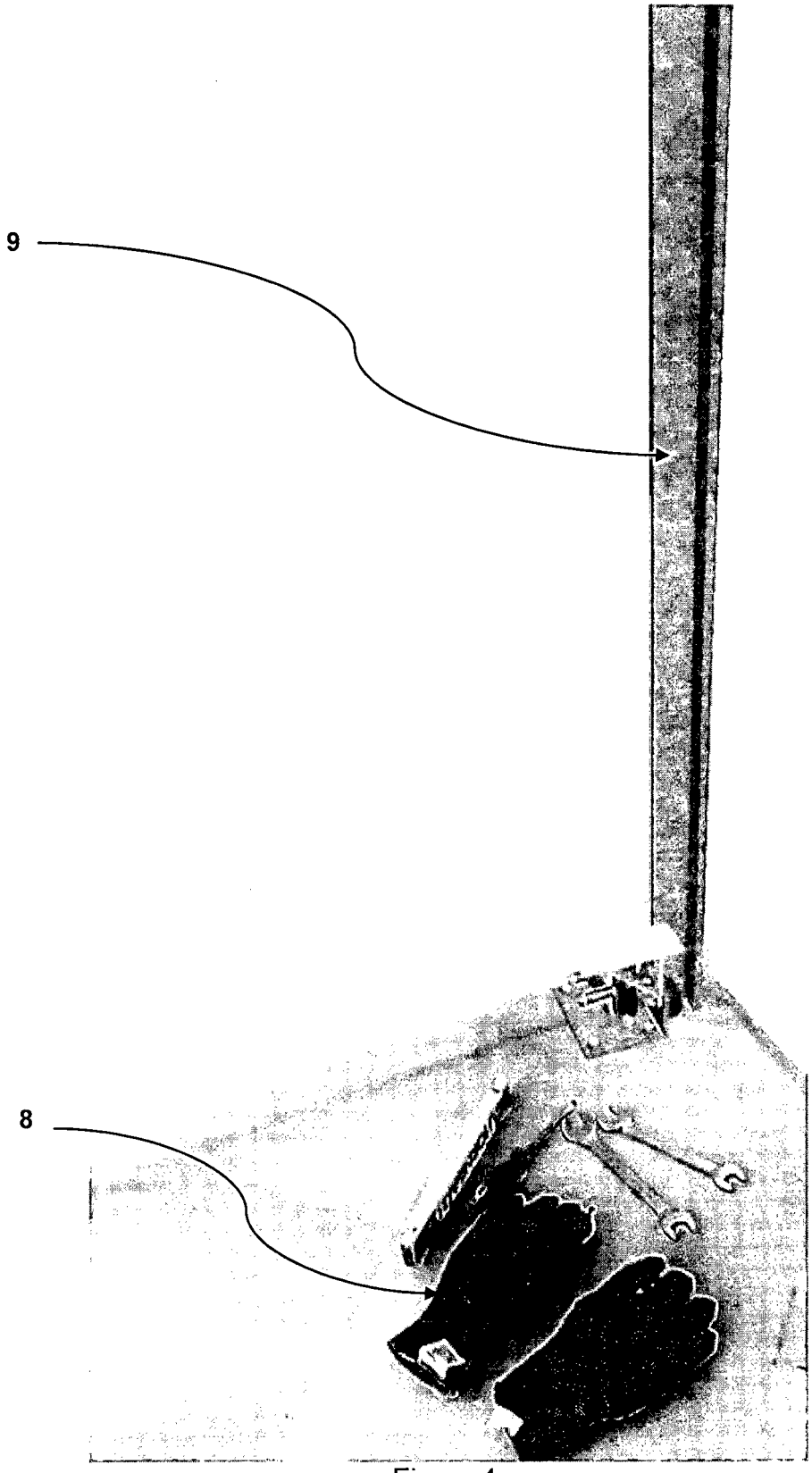

Figure 4.

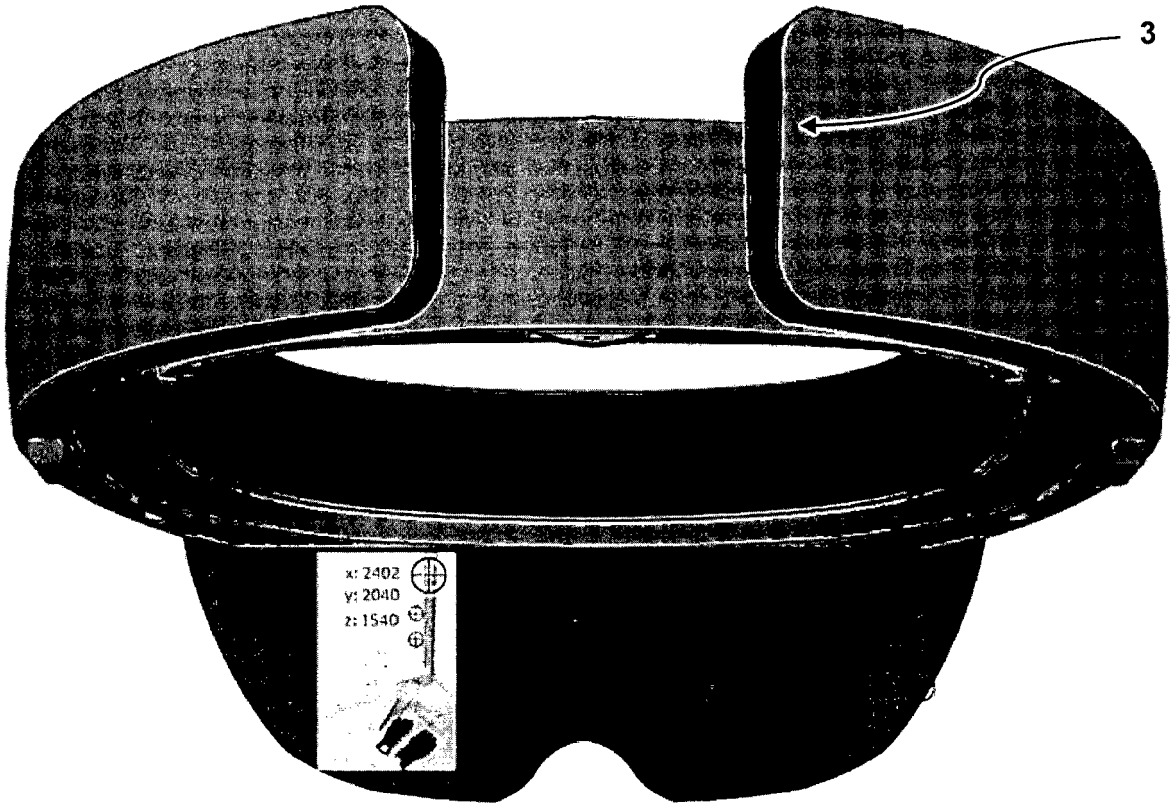

Figure 5.

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EUROPEAN SEARCH REPORT

Application Number
EP 20 38 6042

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	DE 10 2019 203931 A1 (THYSSENKRUPP AG [DE]; THYSSENKRUPP ELEVATOR AG [DE]) 20 February 2020 (2020-02-20)	1-5	INV. B66B19/00
Y	* paragraphs [0015] - [0027] * * figures 1-6 *	6,7	
Y	US 2019/177120 A1 (STUDER CHRISTIAN [CH] ET AL) 13 June 2019 (2019-06-13) * paragraphs [0004], [0005], [0037] - [0044] * * figures 1, 2 *	6,7	

TECHNICAL FIELDS SEARCHED (IPC)

B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 February 2021	Dogantan, Umut H.

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 38 6042

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
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17-02-2021

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