(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 437 752 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
17.06.2020 Bulletin 2020/25

(51) Int Cl.:
B21D 37/14 *(2006.01)*

(21) Application number: **18183151.2**

(22) Date of filing: **12.07.2018**

(54) MULTISTATION CAROUSEL FOR CHANGING A TOOL AND DIE OF A PRESS

MEHRSTUFIGES KARUSSELL ZUM WECHSELN VON WERKZEUG UND MATRIZE EINER PRESSE

CARROUSEL MULTISTATION POUR CHANGER UN OUTIL ET UNE MATRICE D'UNE PRESSE

(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

(30) Priority: **01.08.2017 IT 201700088418**

(43) Date of publication of application:
06.02.2019 Bulletin 2019/06

(73) Proprietor: **Hydromec S.r.l.**
25064 Gussago (Brescia) (IT)

(72) Inventor: **MESCHINI, Francesco**
I-25064 Gussago, BRESCIA (IT)

(74) Representative: **Gualeni, Nadia**
Jacobacci & Partners S.p.A.
Piazza della Vittoria, 11
25122 Brescia (IT)

(56) References cited:
EP-A1- 2 886 219
EP-A1- 2 946 846
JP-A- H07 290 167
US-A- 5 882 285
US-A1- 2013 310 237

EP 3 437 752 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The object of the present invention is a multistation carousel for changing the tool of a press.

[0002] In this sector, the use of tool change tables with a single station, arranged for the horizontal loading of a tool onto a press, is known. These tables have a special mechanism for transferring the tool to be loaded and unloaded in and out of the press. When using a single-station tool change table, the tool must first be removed from the press and then removed from the table with a bridge crane or forklift truck. A new tool is then placed on the table top and pushed into the press. The time required to perform a complete tool change depends on the size and weight of the tool: the larger and heavier the tool, the longer the time required. For example, a four-ton tool may be changed in about 20 minutes.

[0003] The tool change operation alone is therefore rather long and complex and requires the manual work of experienced operators. Document EP 2 946 846 A1 discloses an example of an automatic tool changing device for a press brake, suitable for transferring forming tools from a tool magazine to a forming press and in reverse direction.

[0004] One of the main needs felt in the sector is to be able to handle tools as quickly as possible, in order to reduce the set-up time of the press.

[0005] The object of the present invention is to resolve the problems of the prior art while taking into account the requirements of the sector.

[0006] Such object is achieved by a multistation carousel, which allows the tool of a press to be changed quickly and automatically. In addition, the carousel is equipped with different types of stations, namely a station for loading/unloading the tool from the press, at least one die changing station and at least one pressing simulation or standby station, so as to allow the simultaneous execution of several different operations on different tools, all loaded onto the carousel itself.

[0007] Such object is achieved by a multistation carousel for changing a tool of a press in accordance with claim 1. The dependent claims describe preferred embodiments of the invention.

[0008] Further features and advantages of the invention will become clearer in light of the detailed description of a preferred but not exclusive embodiment, illustrated by way of non-limiting example with the aid of the accompanying figures, wherein:

- figure 1 shows an axonometric view of a multistation carousel for tool changing according to the present invention, in an example embodiment with four stations, whereon three tools are loaded;
- figure 2 shows a view from above of the multistation carousel shown in figure 1;
- figure 3 shows a side section view of the multistation carousel shown in figure 1, showing the station for loading/unloading the tool from the press (left) and a standby station (right);
- figure 4 shows a side section view of the multistation carousel shown in figure 1, wherein a pressing simulation station (left) and a die changing station (right) are visible.

[0009] With reference to the figures cited above, a multistation carousel for changing a tool in accordance with the present invention has been collectively indicated at 1. The carousel 1 is therefore a circular conveyor suitable for changing the dies of a press or for changing the tool of a press.

[0010] Such figure 1 shows an example embodiment of the multistation carousel 1 with four stations 2, three of which accommodate a tool A.

[0011] The carousel 1 is equipped with a load-bearing structure comprising an upper frame 11 supported by pillars 12.

[0012] Below the upper frame 11 is housed a turntable 3 supported by a lower frame 13 that rests directly on the ground.

[0013] The turntable 3 is rotated by rotation means 31, which are housed underneath it on the lower frame 13. The rotation means 31 comprise at least one slewing ring and a toothed pinion-crown assembly driven by a gear motor which controls the rotation. In addition, stopping means located below the turntable 3 are provided to stop the rotation of the same at the stations 2.

[0014] The turntable 3 is divided into a plurality of equal segments 32, each of which corresponds to one station 2.

[0015] Preferably, moreover, between the upper frame 11 and the turntable 3 there are 14 movable walls, for example sliding walls, adapted to separate the turntable 3 into segments 32 to define the operating area of each station 2.

[0016] Preferably, the frame also comprises a central column 15, which extends from the upper frame 11 to the turntable 3, which is hollow internally and adapted to house mechanical components and/or electrical cables for handling the moving parts of the carousel 1.

[0017] The carousel 1 comprises a station 21 for loading/unloading the tool from the press, i.e. one of the segments 32 of the turntable 3 is equipped in such a way as to allow the extraction or insertion of a tool (or of a die) from a press.

[0018] The station 21 is therefore intended to face the exit of the press whereon the tool change is to be carried out.

[0019] The loading/unloading station 21 comprises, adjacent to the turntable 2, an outer frame 22 whereon the tool is guided. The station 21 also comprises a suspension frame 29, equipped with guides and a hydraulic cylinder, suitable for the translation of the tool A. The station 21 then pushes/extracts the tool from the press onto the floor-mounted outer frame 22 and from there onto the turntable 2 via the suspension frame 29.

[0020] The turntable 1 comprises at least one die changing station 23, i.e. one of the segments 32 of the

turntable 3 is equipped in such a way as to allow the removal of the die extracted from the press from the carousel 1 (and in particular from the tool A), the placement on the carousel 1 of a new die in the tool A to be inserted in the press, and the reheating of the die.

[0021] The die changing station 23 is therefore equipped with a mechanical arm 24 to allow the replacement of the die.

[0022] In addition, the carousel 1 comprises at least one work station 25 or standby station 27, i.e. one of the segments 32 of the turntable 3 is equipped in such a way as to allow further activities on the tool A extracted from the press or on the new tool to be inserted into the press.

[0023] The standby station 27 does not require any special equipment, as it is only used as a depot for a tool A awaiting a successive step.

[0024] The work station 25 is, on the other hand, equipped with additional equipment to enable special activities to be carried out on the tool A, such as maintenance, lubrication and pressing simulation.

[0025] The work station 25 is equipped with at least one handling device 26, adapted to allow the radial handling of the tool inside the station 25. Preferably, the handling device 26 is fixed to the upper frame 11. For example, the handling device 26 is a pusher driven by hydraulic cylinders.

[0026] Preferably, the handling device 26 also allows the vertical handling of the tool A. For example, the device 26 is equipped with a vertical ram, driven by a hydraulic cylinder and equipped with automatic locks, to lift the upper die half (or tool half) and allow the operator to simulate a pressing step, complete also with lubrication points.

[0027] Preferably, the work station 25 comprises, adjacent to the turntable 2, an outer frame 28 whereon the tool A is placed, to allow the operator to perform the required activities on the tool.

[0028] Preferably, the multistation carousel 1 is equipped with control and safety systems for the correct and safe operation of the different steps and operations.

[0029] In an example not shown and not in accordance with the claimed invention, the multistation carousel 1 comprises three stations:

- a station 21 for loading/unloading the tool A from the press, equipped with an external frame 22 whereon the tool is slid;
- a standby station 27;
- a die changing station 23 equipped with a mechanical arm 24 suitable to allow the replacement of the die.

[0030] Preferably, the standby station 27 and/or the changing station 23 is also further equipped as a pressing simulation station 25, i.e. it comprises a handling device 26 (radial and preferably also vertical) of the tool A and an outer frame 28 for supporting the tool during the required work activities.

[0031] In a further example, shown in the attached figures, the multistation carousel 1 comprises four stations:

- a station 21 for loading/unloading the tool A from the press, equipped with an external frame 22 on which the tool is slid;
- a pressing simulation station 25, equipped with a handling device 26 (radial and preferably also vertical) of the tool A and an outer frame 28;
- a standby station 27;
- a die changing station 23 equipped with a mechanical arm 24 suitable to allow the replacement of the die.

[0032] Preferably, the standby station 27 and/or the die changing station 23 is also further equipped as a pressing simulation station 25, i.e. it comprises a die handling device 26 (radial and preferably also vertical) and an outer frame 28 for supporting the tool during the required work activities. In the example shown in the figures, only the changing station 23 is also further equipped as pressing simulation station 25.

[0033] Innovatively, a multistation carousel 1 in accordance with the present invention allows the tool and die of a press to be changed quickly and automatically.

[0034] Advantageously, moreover, a multistation carousel 1 in accordance with the present invention, being provided with different types of stations (loading/unloading of the tool from the press, die changing, pressing simulation, standby) allows the simultaneous execution of several different operations on different tools, all loaded on the carousel itself.

[0035] Obviously, one skilled in the art may make modifications to the multistation carousel described above, all contained within the scope of protection as defined by the following claims.

Claims

1. A multistation carousel (1) for changing a tool (A) wherein a die of a press is placed, comprising:

   - a support structure provided with an upper frame (11) supported by pillars (12), and a lower frame (13) which rests directly on the ground;
   - a turntable (3), located below the upper frame (11) and supported by the lower frame (13), rotated by rotation means (31) housed in the lower frame (13), said turntable (3) being divided into segments (32) each of which corresponds to a station (21, 23, 25, 27):

     - a loading/unloading station (21) of the tool (A) from the press;
     - a standby station (27);
     - a die changing station (23);
     - a work station (25), the carousel being

characterised in that
- the work station (25) is equipped with:

-- an outer frame (28) adjacent to the turntable (2) for supporting the tool (A) during processing;
-- a handling device (26) attached to the upper frame (11) to permit the radial and/or vertical handling of the tool (A).

2. A multistation carousel (1) according to claim 1, wherein the work station (25) is equipped with additional equipment to enable maintenance and/or lubrication and/or pressing simulation to be carried out on the tool (A).

3. A multistation carousel (1) according to claim 1 or 2, wherein the standby station (27) and/or the changing station (23) is further equipped with a handling device (26) and an outer frame (28) for supporting the tool.

4. A multistation carousel (1), according to any one of the preceding claims, wherein the handling device (26) is a pusher driven by hydraulic cylinders, fixed to the upper frame (11).

5. A multistation carousel (1), according to any one of the preceding claims, wherein the handling device (26) is equipped with a vertical ram, driven by a hydraulic cylinder, and equipped with automatic locks for lifting an upper tool half and allowing the operator to simulate a pressing step, complete also with lubrication points.

6. A multistation carousel (1), according to any one of the preceding claims, wherein the loading/unloading station (21) comprises:

- an outer frame (22) adjacent to the turntable (2), whereon the tool (A) is slid during entry/exit from the station (21);
- a suspended frame (29) above the turntable (2), adapted to move the tool (A) in/out of the station (21).

7. A multistation carousel (1), according to any one of the preceding claims, wherein the die changing station (23) is provided with a mechanical arm (24) for replacing the die.

8. A multistation carousel (1), according to any one of the preceding claims, wherein the rotating means (31) of the turntable (3) comprise at least one slewing ring and a toothed pinion-crown assembly driven by a gear motor that controls the rotation.

9. A multistation carousel (1), according to any one of the preceding claims, comprising stopping means, positioned below the turntable (3), to stop the rotation of the turntable (3) at the desired station.

10. A multistation carousel (1), according to any one of the preceding claims, wherein moving walls (14) are arranged between the upper frame (11) and the turntable (3) to separate the turntable (3) into segments (31) and to define an operating area for each station (2).

11. A multistation carousel (1), according to any one of the preceding claims, wherein the support structure comprises a central column (15) extending from the upper frame (11) to the turntable (3), internally hollow, to accommodate mechanical components and/or electrical wiring.

Patentansprüche

1. Ein Mehrstationen-Karussell (1) zum Wechseln eines Werkzeugs (A), in dem eine Matrize einer Presse angeordnet ist, umfassend:

- eine Stützstruktur mit einem oberen Rahmen (11), der von Säulen (12) getragen wird, und einem unteren Rahmen (13), der direkt auf dem Boden ruht;
- eine Drehscheibe (3), die sich unter dem oberen Rahmen (11) befindet und von dem unteren Rahmen (13) getragen wird, die durch in dem unteren Rahmen (13) untergebrachte Drehmittel (31) gedreht wird, wobei die Drehscheibe (3) in Segmente (32) unterteilt ist, von denen jedes einer Station (21, 23, 25, 27) entspricht:

- eine Be-/Entladestation (21) des Werkzeugs (A) von der Presse;
- eine Bereitschaftsstation (27);
- eine Matrizenwechselstation (23);
- eine Arbeitsstation (25), wobei das Karussell **dadurch gekennzeichnet ist, dass**
- der Arbeitsplatz (25) ausgestattet ist mit:

-- einen äußeren Rahmen (28) neben dem Drehtisch (2) zur Abstützung des Werkzeugs (A) während der Bearbeitung;
-- eine Handhabungsvorrichtung (26), die an dem oberen Rahmen (11) befestigt ist, um die radiale und/oder vertikale Handhabung des Werkzeugs (A) zu ermöglichen.

2. Ein Mehrstationen-Karussell (1) nach Anspruch 1, wobei die Arbeitsstation (25) mit zusätzlichen Einrichtungen ausgestattet ist, um die Wartung

und/oder die Schmierung und/oder die Simulation des Pressens am Werkzeug (A) zu ermöglichen.

3. Ein Mehrstationen-Karussell (1) nach Anspruch 1 oder 2, wobei die Bereitschaftsstation (27) und/oder die Wechselstation (23) ferner mit einer Handhabungsvorrichtung (26) und einem Außenrahmen (28) zur Aufnahme des Werkzeugs ausgestattet ist.

4. Ein Mehrstationen-Karussell (1) nach einem der vorstehenden Ansprüche, wobei die Handhabungsvorrichtung (26) ein durch Hydraulikzylinder angetriebener Schieber ist, der am oberen Rahmen (11) befestigt ist.

5. Ein Mehrstationen-Karussell (1) nach einem der vorstehenden Ansprüche, wobei die Handhabungsvorrichtung (26) mit einem vertikalen Stößel ausgestattet ist, der von einem Hydraulikzylinder angetrieben wird und mit automatischen Verriegelungen zum Anheben einer oberen Werkzeughälfte ausgestattet ist und es dem Bediener ermöglicht, einen Pressschritt zu simulieren, der auch mit Schmierstellen versehen ist.

6. Ein Mehrstationen-Karussell (1) gemäß einem der vorstehenden Ansprüche, wobei die Be-/Entladestation (21) umfasst:

- einen äußeren Rahmen (22) neben dem Drehtisch (2), auf dem das Werkzeug (A) während des Ein- und Ausfahrens aus der Station (21) geschoben wird;
- einen Hängerahmen (29) über dem Drehtisch (2), der dazu geeignet ist, das Werkzeug (A) in die Station (21) hinein- und herauszubewegen.

7. Ein Mehrstationen-Karussell (1) nach einem der vorstehenden Ansprüche, wobei die Matrizenwechselstation (23) mit einem mechanischen Arm (24) zum Auswechseln der Matrize versehen ist.

8. Ein Mehrstationen-Karussell (1) nach einem der vorstehenden Ansprüche, wobei die Rotationsmittel (31) des Drehtisches (3) mindestens einen Drehkranz und eine Zahnrad-Kronen-Anordnung umfassen, die von einem Getriebemotor angetrieben wird, der die Rotation steuert.

9. Ein Mehrstationen-Karussell (1) nach einem der vorstehenden Ansprüche, das eine unter dem Drehtisch (3) angeordnete Stoppvorrichtung zum Anhalten der Drehung des Drehtisches (3) an der gewünschten Station umfasst.

10. Ein Mehrstationen-Karussell (1) nach einem der vorstehenden Ansprüche, bei dem bewegliche Wände (14) zwischen dem oberen Rahmen (11) und der Drehscheibe (3) angeordnet sind, um die Drehscheibe (3) in Segmente (31) zu trennen und einen Arbeitsbereich für jede Station (2) zu definieren.

11. Ein Mehrstationen-Karussell (1) nach einem der vorstehenden Ansprüche, wobei die Tragstruktur eine zentrale Säule (15) umfasst, die sich vom oberen Rahmen (11) bis zum Drehtisch (3) erstreckt und innen hohl ist, um mechanische Komponenten und/oder elektrische Leitungen aufzunehmen.

Revendications

1. Carrousel multistation (1) pour changer un outil (A), dans lequel est placée la matrice d'une presse, comprenant :

- une structure de support munie d'un cadre supérieur (11) supporté par des piliers (12), et d'un cadre inférieur (13) qui repose directement sur le sol ;
- un plateau tournant (3), situé sous le cadre supérieur (11) et supporté par le cadre inférieur (13), mis en rotation par des moyens de rotation (31) logés dans le cadre inférieur (13), ledit plateau tournant (3) étant divisé en segments (32) dont chacun correspond à une station (21, 23, 25, 27) :
  - une station de chargement/déchargement (21) de l'outil (A) depuis la presse ;
  - une station d'attente (27) ;
  - une station de changement de matrice (23) ;
  - une station de travail (25), le carrousel étant **caractérisé en ce que**
  - la station de travail (25) est équipée de :
    -- un cadre externe (28) adjacent au plateau tournant (2) et destiné à supporter l'outil (A) pendant le traitement ;
    -- un dispositif de manipulation (26) attaché au cadre supérieur (11) et permettant la manipulation radiale et/ou verticale de l'outil (A).

2. Carrousel multistation (1) selon la revendication 1, dans lequel la station de travail (25) est équipée d'un équipement supplémentaire permettant la réalisation d'une maintenance et/ou d'une lubrification et/ou d'une simulation de pressage à réaliser sur l'outil (A).

3. Carrousel multistation (1) selon la revendication 1 ou 2, dans lequel la station d'attente (27) et/ou la station de changement (23) est/sont en outre équipée(s) d'un dispositif de manipulation (26) et d'un

cadre externe (28) pour supporter l'outil.

4. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, dans lequel le dispositif de manipulation (26) est un poussoir entraîné par des vérins hydrauliques et fixé au cadre supérieur (11).

5. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, dans lequel le dispositif de manipulation (26) est équipé d'un coulisseau vertical, entraîné par un vérin hydraulique, et équipé de verrous automatiques pour lever une moitié d'outil supérieure et permettre à l'opérateur de simuler une étape de pressage, complétée également avec des points de lubrification.

6. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, dans lequel la station de chargement/déchargement (21) comprend :

- un cadre externe (22) adjacent au plateau tournant (2), sur lequel l'outil (A) coulisse pendant l'entrée/la sortie dans/depuis la station (21) ;
- un cadre suspendu (29) au-dessus du plateau tournant (2), adapté pour déplacer l'outil (A) à l'intérieur/à l'extérieur de la station (21).

7. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, dans lequel la station de changement de matrice (23) est munie d'un bras mécanique (24) permettant de remplacer la matrice.

8. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, dans lequel les moyens de rotation (31) du plateau tournant (3) comprennent au moins une couronne d'orientation et un ensemble pignon denté-couronne entraîné par un moteur à engrenages qui commande la rotation.

9. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, comprenant des moyens d'arrêt, positionnés sous le plateau tournant (3) et destinés à arrêter la rotation du plateau tournant (3) à la station souhaitée.

10. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, dans lequel des parois mobiles (14) sont agencées entre le cadre supérieur (11) et le plateau tournant (3) pour séparer le plateau tournant (3) en segments (31) et pour définir une zone fonctionnelle pour chaque station (2).

11. Carrousel multistation (1) selon l'une quelconque des revendications précédentes, dans lequel la structure de support comprend une colonne centrale (15) s'étendant du cadre supérieur (11) au plateau tournant (3), creuse à l'intérieur et destinée à loger des composants mécaniques et/ou un câblage électrique.

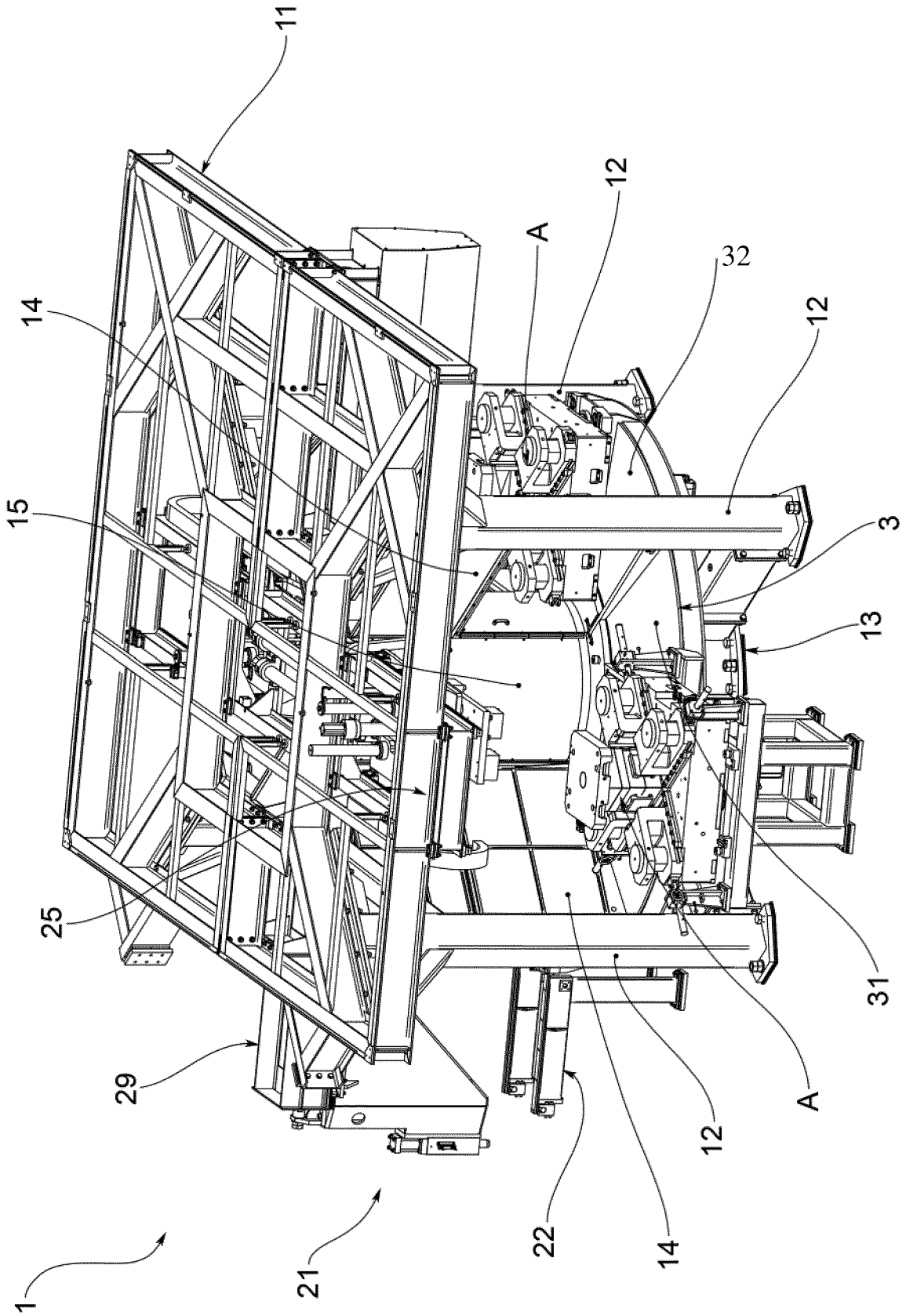

FIG.1

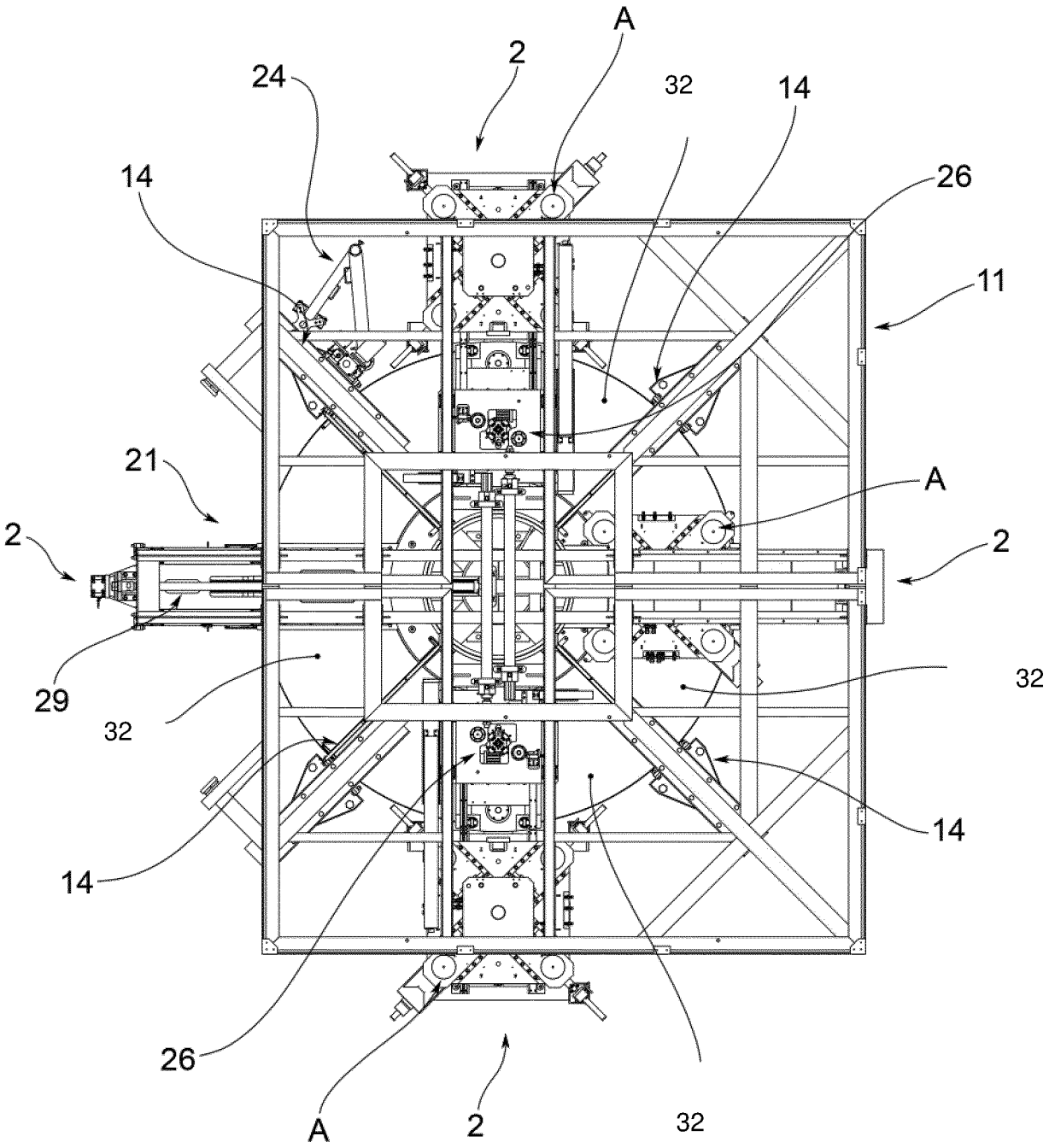

FIG.2

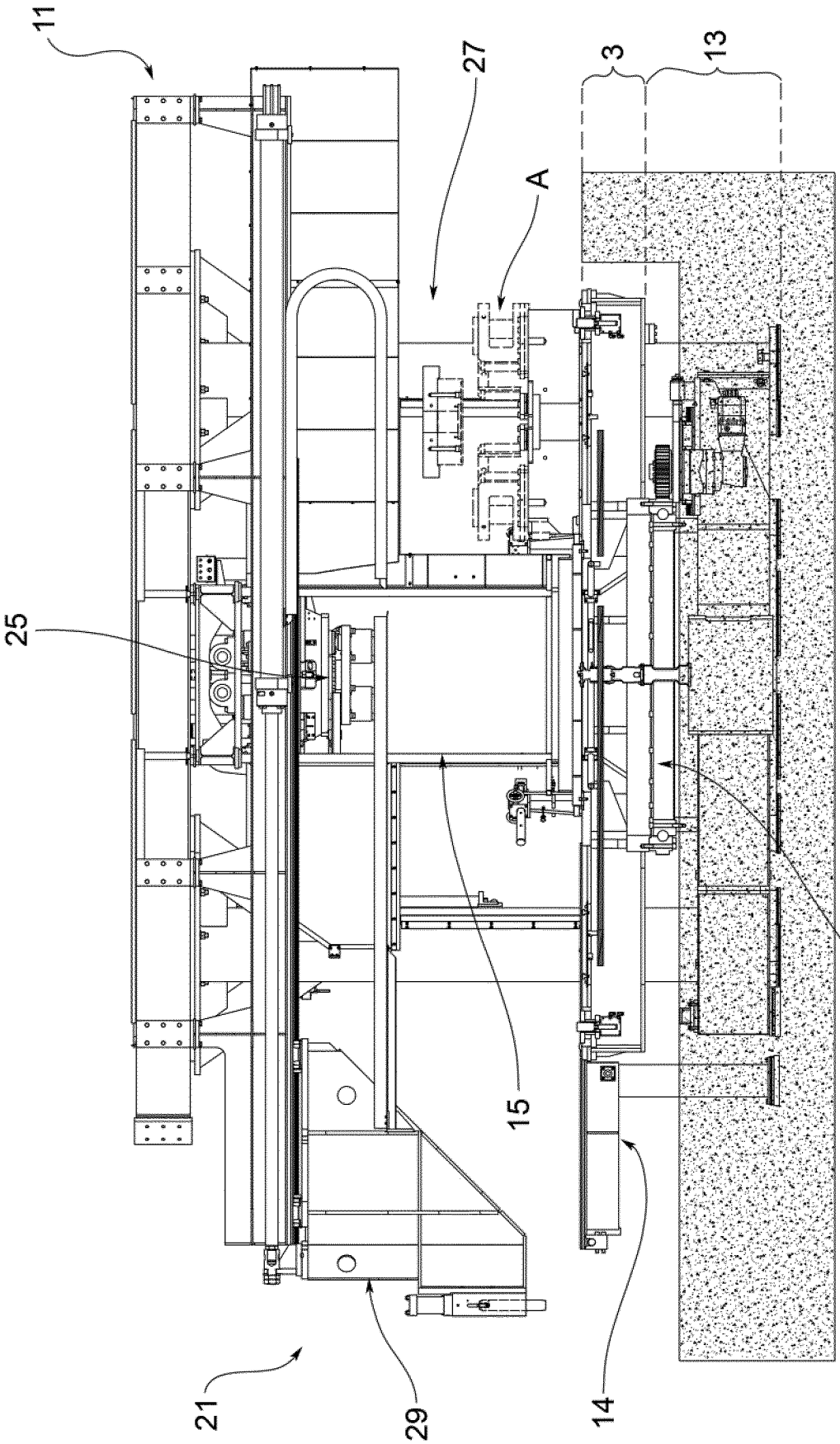

FIG.3

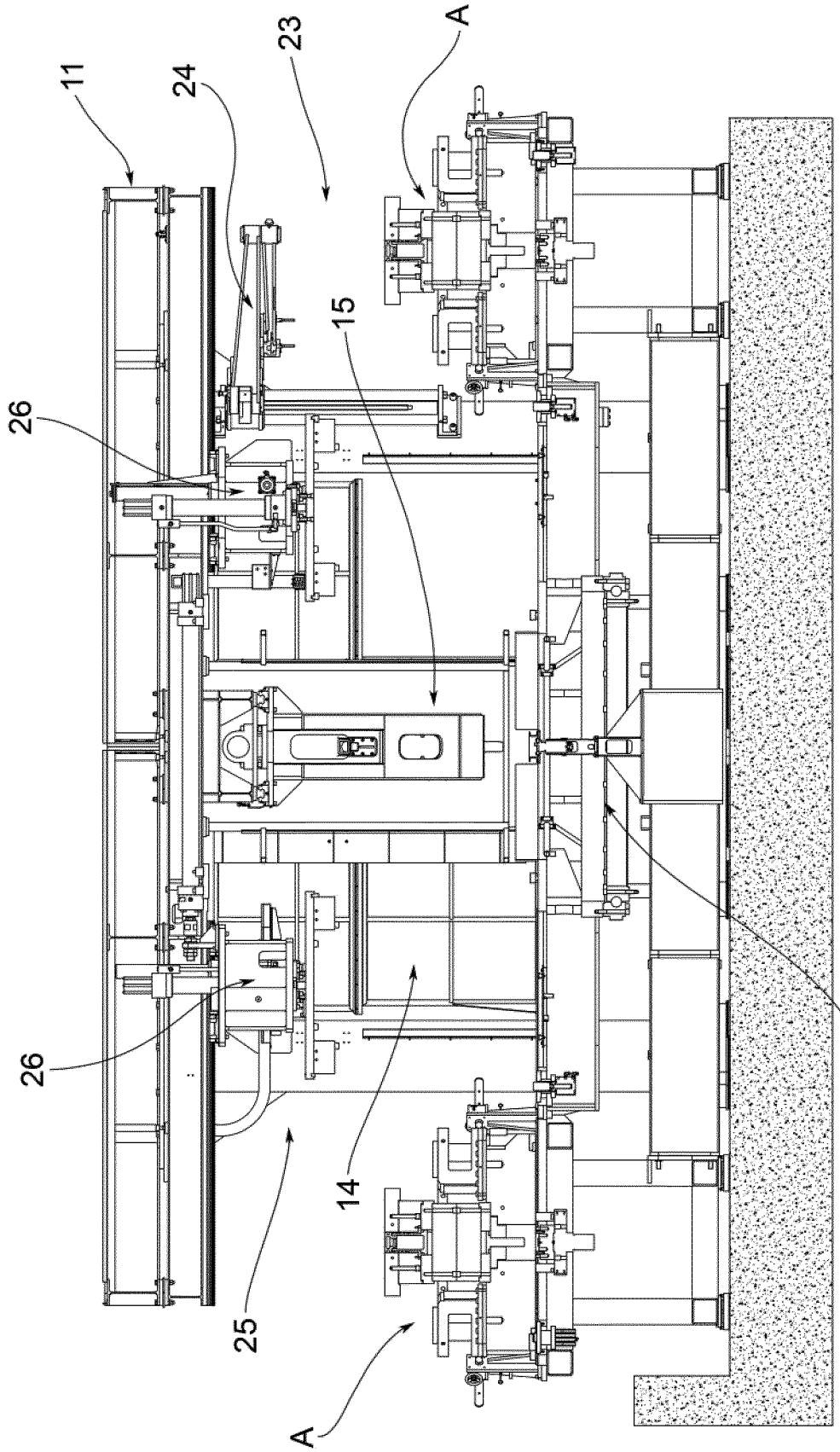

FIG.4

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2946846 A1 **[0003]**