

(19)



(11)

**EP 2 905 421 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**24.05.2017 Bulletin 2017/21**

(51) Int Cl.:  
**E21C 29/02<sup>(2006.01)</sup> E21C 35/12<sup>(2006.01)</sup>**  
**E21C 27/02<sup>(2006.01)</sup>**

(21) Application number: **14154360.3**

(22) Date of filing: **07.02.2014**

(54) **Shearer loader for underground mining with bearing units within mainframe**

Strebowalzenlader für den Untertagbergbau mit Lagereinheiten mit Hauptrahmen

Chargeuse à cylindres pour l'exploitation minière souterraine avec des unités de palier dans le cadre principal

(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**

(43) Date of publication of application:  
**12.08.2015 Bulletin 2015/33**

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(56) References cited:  
**US-A- 557 340 US-A- 4 027 918**

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## Description

### Technical Field

**[0001]** The present disclosure refers in general to a shearer loader for underground mining. More particularly, the disclosure refers to a shearer loader comprising a mainframe extending in a longitudinal axis and having a first end portion and a second end portion opposite the first end portion. A ranging arm is swivel-mounted at least at one of the first and second end portions of the mainframe. The ranging arm may be provided with at least one cutting drum pivot-mounted at the ranging arm. At least one shearer loader component is configured to be mounted at the mainframe in a removable manner, for example a haulage motor or an electrical control box.

### Background

**[0002]** Shearer loaders for underground mining are also known as longwall shearers. Such shearers comprise a mainframe with fabricated structure to meet even the toughest mining conditions. During operation of a longwall shearer the mainframe is travelling along rails and the cutting drum rotates to cut the desired mineral, in particular underground coal. The cutting drum rotates about an axis perpendicular to the mine wall and includes vanes extending along the cutting drum. The ranging arm can raise the drum to mine material at different heights.

**[0003]** A longwall shearer having two cutting drums at different ends of the mainframe is for example shown in US 7,954,904 B2, US 2012/0267940 A1 and AU-B-83820/91.

**[0004]** Due to the tough conditions during operation of longwall shearers large and/or heavy shearer components may have to be replaced. Assembly and removal of such major shearer components from the mainframe of the shearer shall be easy and safe. However, due to the fact that longwall shearers have different sizes, the mainframe and other major components of the shearer have different dimensions. Hence, sometimes the available clearance or free space for removal and assembly of such major components in or from the machine may be very small. The latter is particularly the case if the longwall shearer is a low height machine for low seams. In this case, the remaining clearance in the mainframe for the major components like e.g. a haulage motor is very small. Accordingly, the use of cranes and forklifts to handle the shearer components to be assembled or removed from the mainframe of the shearer could be problematic.

### Summary of the Disclosure

**[0005]** In one aspect of the present disclosure, a shearer loader for underground mining is disclosed. A shearer loader comprises a mainframe extending in a longitudinal axis and having a first end portion and a second end

portion opposite the first end portion. A ranging arm is swivel-mounted at least at one of the first and second end portions of the mainframe. The ranging arm is provided with at least one cutting drum pivot-mounted at the ranging arm. At least one shearer loader component is configured to be mounted at the mainframe in a removable manner. Further, the shearer loader comprises a bearing unit arranged at the mainframe at such a position that the at least one bearing unit supports the at least one shearer loader component when it is moved with respect to the mainframe during assembly or disassembly. Moving of the shearer loader component is necessary if the component has to be mounted to or dismounted from the mainframe, i.e. for example if the component has to be replaced or a maintenance of that component is necessary

### Brief Description of the Drawings

#### [0006]

Fig. 1 is a schematic side view of an exemplary longwall shearer according to the present disclosure;

Fig. 2 is a schematic front view of the longwall shearer of Fig. 1;

Fig. 3 is a perspective view of a part of a mainframe of a longwall shearer shown in Fig. 1 and 2 and a haulage motor to be mounted thereon;

Fig. 4 is a schematic perspective sectional view of a haulage motor at a mainframe of the longwall shearer of Figs. 1 and 2;

Fig. 5 is a schematic perspective sectional view similar to that of Fig. 4, but the haulage motor is already moved;

Fig. 6 is a further schematic perspective sectional view similar to that of Figs. 4 and 5, but the haulage motor is further moved to its final position;

Fig. 7 is a schematic front view of the haulage motor on a bearing unit of the mainframe of the longwall shearer shown in Figs. 1 and 2;

Fig. 8 shows a detail of the support of the haulage motor shown in Fig. 7;

Fig. 9 shows another perspective view of an assembled haulage motor at the mainframe of the longwall shearer shown in Figs. 1 and 2;

Fig. 10 shows a perspective view of the haulage motor of Figs. 3-9;

Fig. 11 is a schematic perspective view of a part of the mainframe of the longwall shearer of Fig. 1 and 2, where the haulage motor of Fig. 10 is to be mounted;

Fig. 12 is a perspective top view of a bottom portion of that part of the mainframe shown in Fig. 11;

Fig. 13 is a schematic perspective view of a bearing unit to be arranged at the mainframe of the longwall shearer of Figs. 1 and 2;

Fig. 14 is another schematic perspective view of the bearing unit shown in Fig. 13 with an elevated upper

bearing block;

Fig. 15 is a schematic sectional view of the bearing unit shown in Figs. 13 and 14;

Fig. 16 is a schematic perspective view of a roller element of a bearing unit shown in Figs 13 to 15.

#### Detailed Description

**[0007]** Fig. 1 shows a schematic side view of an exemplary embodiment of a longwall shearer 10 according to the present disclosure. The longwall shearer comprises a mainframe 15 and two ranging arms 20, 25. The two ranging arms 20, 25 are swivel-mounted at respective end portions 30, 35 of the mainframe 15. Both ranging arms 20, 25 are provided with cutting drums 40, 45. Each cutting drum 40, 45 is pivot-mounted at an end of the associated ranging arm 20, 25. The ranging arms 20, 25 and the respective cutting drum 40, 45 is adjustable to the height of a seam 50 to be mined.

**[0008]** Fig. 2 shows a schematic front view of the longwall shearer 10 of Fig. 1. As usual, the longwall shearer 10 runs on rails 60, 65 of a conveyer 55. The longwall shearer 10 is driven by a haulage motor 100 (not shown in Figs. 1 and 2) mounted within the mainframe 15 and connected to a gear for propelling longwall shearer 10 on a tooth rack 70. The tooth rack 70 extends along the rail 60 of conveyer 55.

**[0009]** The longwall shearer shown in Figs. 1 and 2 is adapted to load seams. For example, the longwall shearer 10 may cover seam heights from 63 to 126 inches (1.6 to 3.2 m). Due to the low seam shearer applications, the mainframe 15 of shearer loader 10 has to be quiet compact and, therefore, the assembly and disassembly of some major shearer loader components like, e.g. a haulage motor 100, might be difficult due to the weight and little space available for handling these components.

**[0010]** Particularly, haulage motor 100 may have to be assembled to the mainframe 15 of shearer loader 10 underground or has to be removed for maintenance purposes. Handling of such a shearer loader component like the haulage motor 100 by a crane or forklift could be difficult and even impossible.

**[0011]** As already mentioned before, the whole longwall shearer loader 10 moves on rails 60, 65 driven by a haulage motor 100, see for example Fig. 11. Such a haulage motor 100 may provide a maximum power rating of 100kW and has an overhaul weight of approximately 500 kg at the minimum. A haulage motor 100 configured to be used in a rather small longwall shearer loader 10 might have a diameter of at least 400 mm and a length of at least 900 mm. Haulage motors for other longwall shearer larger dimensions might be larger and heavier.

**[0012]** The haulage motor 100 has to be connected to a gear box located within mainframe 15, see for example Figs. 9 to 12. Fig. 12 shows a part of the mainframe 15 without haulage motor 100. Contrary to the view shown in Fig. 12, Fig. 10 shows a view including haulage motor 100 mounted to the mainframe 15.

**[0013]** Due to the weight and the dimensions and also due to the small clearance within mainframe 15, the assembly and disassembly of haulage motor 100 might be difficult to be carried out with known handling equipment.

**[0014]** Referring to Figs. 3-12, according to the present disclosure a bottom portion 105 of mainframe 15 located in front of a mounting flange 110 for a haulage motor 100 is provided with one or more bearing units 115. A fixed support flange 120 can be arranged on the bottom portion 105 such that the bearing units 115 are located between support flange 120 and mounting flange 110, see for example Figs. 4-6 and Fig. 12.

**[0015]** A bearing unit 115 is shown in more details in Figs. 13-16. Here, a bearing unit 115 comprises a lower bearing block 125 fixed to the bottom portion 105 of mainframe 15 by, for example, welding. As shown in Figs. 14 and 15, lower bearing block 125 comprises a center hole 145 and a flat upper face 160. An upper bearing block 130 comprises a flat lower face 165 and a centering pin 140. The centering pin 140 of the upper bearing block 130 fits in center hole 145 of lower bearing block 125.

**[0016]** In the exemplary embodiment of a bearing unit 115 shown in Figs. 13-15 four roller elements 135 are removably arranged on upper bearing block 130.

**[0017]** The principle structure of an exemplary embodiment of roller element 135 is shown in Fig. 16. The roller element 135 has a shaft 165 and an upper contact face 150. A lubricated roller 155 or ball is freely rotatable supported within the roller element 135.

**[0018]** Due to the above structure of a bearing unit 115 the upper bearing blocks can be replaced, if desired. The rollers 155 allow support of a load like, e.g., haulage motor 100 to be moved thereon in any desired direction parallel to the plane defined by upper bearing block 130. In addition, a load supported by one or more bearing units 115 may even be rotated around an axis extending parallel to the plane defined by the upper bearing block 130.

**[0019]** As shown in Figs. 14 and 15, the upper bearing block 130 can be lifted from the lower bearing block 125. Due to this configuration of an exemplary embodiment of a bearing unit 115 a shim (not shown) may be placed between the two faces 165 and 160 of the upper and lower blocks 130, 125. Dependent from the height of the shim the support height of the bearing unit 115 can be adjusted to the component to be supported.

**[0020]** Different longwall shearers 10 have different dimensions and, most likely, the haulage motors to be used therein have different dimensions, too. If the bearing units 115 shall be used in all kind of longwall shearers 10, the support height for the haulage motor 100 might be different.

**[0021]** Due to use of at least one shim to be placed between a lower bearing block and an upper bearing block, the same kind of bearing units can be used in different longwall shearers even if the respective haulage motors have different sizes. Of course, the same applies to other shearer loader components to be moved with respect to the frame during assembly or disassembly.

**[0022]** A mainframe according to the present disclosure may not only protect all the modular shearer loader components but also enables selective overhaul and modular unit exchange for the most efficient maintenance in the industry.

#### Industrial Applicability

**[0023]** Longwall shearers 10 disclosed herein are configured for underground mining. For maintenance haulage motor 100 may be removed from the mainframe 15 of the longwall shearer 10 and later be assembled again.

**[0024]** Referring now to Figs. 3 to 5, 7 and 8, the mounting process is explained in more details. As shown in Fig. 3, haulage motor 100 can be placed on support flange 120 by means of known equipment (not shown). Supported by support flange 120 the haulage motor is pushed horizontally in the direction to a mounting flange 110. Haulage motor 100 has finally be mounted to mounting flange 110 during operation of the longwall shearer 10.

**[0025]** Due to the arrangement of one or more bearing units 115 between support flange 120 and mounting flange 110, haulage motor 100 is supported across the whole distance to the mounting flange 110. Hence, it might not be necessary to use forklifts or similar devices for moving the haulage motor 100 up to mounting flange 110. As the bearing units 115 have for example roller elements 155, the forces necessary for pushing haulage motor 100 to mounting flange 110 are relatively low and a worker might easily handle the transport, although the clearance in the mainframe is very small.

**[0026]** The roller elements 155 allow movement of a load in all directions. Therefore, it might be very easy for a worker to rotate haulage motor 100 already pushed to the correct mounting position in the correct mounting orientation. When haulage motor 100 is correctly oriented, haulage motor can easily mounted to mounting flange 110 by for example bolts (not shown). That handling might be very difficult with support by means of common devices in the small clearance provided in the mainframe.

**[0027]** Although the preferred embodiments of this invention have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims.

#### **Claims**

1. A shearer loader (10) for underground mining, comprising:

a mainframe (15) extending in a longitudinal axis and having a first end portion (30) and a second end portion (35) opposite the first end portion (30);

a ranging arm (20, 25) swivel-mounted at least at one of the first and second end portions (30, 35) of the mainframe (15), the ranging arm (20,

25) being provided with at least one cutting drum (40, 45) pivot-mounted at the ranging arm (20, 25);

at least one shearer loader component (100) configured to be mounted to the mainframe (15) in a removable manner, but fixedly mounted to the mainframe (15) during operation of the shearer loader (10); and **characterised in that** the shearer loader further comprises at least one bearing unit (115) arranged at the mainframe (15) at such a position that the at least one bearing unit (115) supports the at least one shearer loader component (100) when it is moved with respect to the mainframe (15) during assembly or disassembly.

2. The shearer loader (10) of claim 1, the at least one bearing unit (115) including at least one lower bearing block (125) mounted to the mainframe (15) and an upper bearing block (130) configured to be engaged with the lower bearing block (125), the upper bearing block (130) supports at least one bearing element (135).
3. The shearer loader (10) of claim 2, the at least one lower bearing block (125) being fixedly mounted to the mainframe (15).
4. The shearer loader (10) of any one of the preceding claims, the at least one lower bearing block (125) including at least one engagement part (145) configured to be engaged with at least one corresponding engagement part (140) of the at least one upper bearing block (130).
5. The shearer loader (10) of any one of the preceding claims, wherein the bearing unit (115) comprises a plurality of ball bearings (135) and/or slide bearings.
6. The shearer loader (10) of any one of the preceding claims, wherein the bearing unit (115) is configured to be positioned at different heights with respect to the mainframe (15).
7. The shearer loader (10) of any one of claims 2 to 6, wherein a shim having a defined height is provided between the lower bearing block (125) and the upper bearing block (130) to provide support for the shearer loader component (100) dependent from the dimensions of the shearer loader component (100) to be supported.
8. The shearer loader (10) of any one of the preceding claims, the at least one shearer loader component is at least one of the group of components comprising a haulage motor (100), a power drive configured to swivel the at least one ranging arm, a power drive configured to pivot the at least one cutting drum (40,

45), and an electrical control box.

9. The shearer loader (10) of any one of the preceding claims, the at least one shearer loader component (100) has a mass of at least 200 kg, preferably more than 400 kg or 500 kg.
10. The shearer loader (10) of any one of the preceding claims, the at least one shearer loader component (100) has a length of at least 500 mm, particularly more than 800 mm, and/or a diameter of at least 200 mm, particularly more than 350 mm.

#### Patentansprüche

1. Walzenlader (10) für den Untertagebau, umfassend:

einen sich entlang einer Längsachse erstreckenden Hauptrahmen (15) mit einem ersten Endstück (30) sowie einem zweiten Endstück (35) gegenüber dem ersten Endstück (30);  
einen Tragarm (20, 25), der an mindestens einem der ersten und zweiten Endstücke (30, 35) des Hauptrahmens (15) schwenkbar befestigt ist, wobei der Tragarm (20, 25) mit mindestens einer drehbar am Tragarm (20, 25) befestigten Schneidwalze (40, 45) ausgestattet ist;  
mindestens eine Walzenlader-Komponente (100), die so konfiguriert ist, dass sie am Hauptrahmen (15) entfernbar befestigt ist, während des Betriebs des Walzenladers (10) jedoch starr am Hauptrahmen (15) befestigt ist;  
**dadurch gekennzeichnet, dass** der Walzenlader weiter mindestens eine in einer solchen Position am Hauptrahmen (15) angeordnete Lagereinheit (115) umfasst, sodass zumindest eine Lagereinheit (115) die mindestens eine Walzenlader-Komponente (100) stützt, wenn diese während der Montage oder Demontage in Bezug auf den Hauptrahmen (15) bewegt wird.

2. Walzenlader (10) nach Anspruch 1, wobei die mindestens eine Lagereinheit (115) mindestens einen am Hauptrahmen (15) befestigten unteren Lagerblock (125) und einen oberen Lagerblock (130) einschließt, der so konfiguriert ist, dass er in den unteren Lagerblock (125) eingreift, wobei der obere Lagerblock (130) mindestens ein Lagerelement (135) stützt.
3. Walzenlader (10) nach Anspruch 2, wobei der mindestens eine untere Lagerblock (125) starr am Hauptrahmen (15) befestigt ist.
4. Walzenlader (10) nach einem der vorstehenden Ansprüche, wobei der mindestens eine untere Lagerblock (125) mindestens ein Eingreifteil (145) ein-

schließt, das so konfiguriert ist, dass es in mindestens ein entsprechendes Eingreifteil (140) des mindestens einen oberen Lagerblocks (130) eingreift.

5. Walzenlader (10) nach einem der vorstehenden Ansprüche, wobei die Lagereinheit (115) eine Vielzahl von Kugellagern (135) und/oder Gleitlagern umfasst.
6. Walzenlader (10) nach einem der vorstehenden Ansprüche, wobei die Lagereinheit (115) so konfiguriert ist, dass sie in verschiedenen Höhen in Bezug auf den Hauptrahmen (15) positioniert werden kann.
7. Walzenlader (10) nach einem der vorstehenden Ansprüche 2 bis 6, wobei ein Abstandsblech mit einer festgelegten Höhe zwischen dem unteren Lagerblock (125) und dem oberen Lagerblock (130) bereitgestellt wird, um die Walzenlader-Komponente (100) in Abhängigkeit von den Abmessungen der zu stützenden Walzenlader-Komponente (100) zu stützen.
8. Walzenlader (10) nach einem der vorstehenden Ansprüche, wobei die mindestens eine Walzenlader-Komponente mindestens eine der Komponenten-Gruppe ist, die einen Fördermotor (100), einen zum Drehen des mindestens einen Tragarms konfigurierten Kraftantrieb, einen zur Schwenkung der mindestens einen Schneidwalze (40, 45) konfigurierten Kraftantrieb und einen elektrischen Schaltkasten umfasst.
9. Walzenlader (10) nach einem der vorstehenden Ansprüche, wobei die mindestens eine Walzenlader-Komponente (100) ein Gewicht von mindestens 200 kg, vorzugsweise von mehr als 400 kg oder 500 kg umfasst.
10. Walzenlader (10) nach einem der vorstehenden Ansprüche, wobei die mindestens eine Walzenlader-Komponente (100) eine Länge von mindestens 500 mm, insbesondere von mehr als 800 mm, und/oder einen Durchmesser von mindestens 200 mm, insbesondere von mehr als 350 mm besitzt.

#### Revendications

1. Haveuse-chargeuse (10) pour exploitation minière souterraine, comprenant :

un cadre principal (15) s'étendant sur un axe longitudinal et ayant une première partie d'extrémité (30) et une seconde partie d'extrémité (35) opposée à la première partie d'extrémité (30) ;  
un bras de réglage (20, 25) monté à rotation au moins sur l'une des première et seconde parties

- d'extrémité (30, 35) du cadre principal (15), le bras de réglage (20, 25) étant pourvu d'au moins un tambour de coupe (40, 45) monté à pivotement sur le bras de réglage (20, 25) ;  
 au moins un composant de haveuse-chargeuse (100) configuré pour être monté sur le cadre principal (15) de manière amovible, mais monté fixe sur le cadre principal (15) au cours du fonctionnement de la haveuse-chargeuse (10) ; et  
**caractérisée en ce que** la haveuse-chargeuse comprend au moins une unité de palier (115) agencée sur le cadre principal (15) dans une position telle que la au moins une unité de palier (115) supporte le au moins un composant de haveuse-chargeuse (100) lorsqu'il est déplacé par rapport au cadre principal (15) en cours de montage ou de démontage.
2. Haveuse-chargeuse (10) selon la revendication 1, la au moins une unité de palier (115) comprenant au moins un bloc palier inférieur (125) monté sur le cadre principal (15) et un bloc palier supérieur (130) configuré pour s'engager sur le bloc palier inférieur (125), le bloc palier supérieur (130) supportant au moins un élément de palier (135).
  3. Haveuse-chargeuse (10) selon la revendication 2, le au moins un bloc palier inférieur (125) étant monté fixe sur le cadre principal (15).
  4. Haveuse-chargeuse (10) selon l'une quelconque des revendications précédentes, le au moins un bloc palier inférieur (125) comprenant au moins une partie d'engagement (145) configurée pour s'engager sur au moins une partie d'engagement correspondante (140) du au moins un bloc palier supérieur (130).
  5. Haveuse-chargeuse (10) selon l'une quelconque des revendications précédentes, dans laquelle l'unité de palier (115) comprend une pluralité de roulements à billes (135) et/ou de paliers lisses.
  6. Haveuse-chargeuse (10) selon l'une quelconque des revendications précédentes, dans laquelle l'unité de palier (115) est configurée pour être positionnée à différentes hauteurs par rapport au cadre principal (15).
  7. Haveuse-chargeuse (10) selon l'une quelconque des revendications 2 à 6, dans laquelle une cale ayant une hauteur définie est disposée entre le bloc palier inférieur (125) et le bloc palier supérieur (130) pour fournir un support au composant de haveuse-chargeuse (100) en fonction des dimensions du composant de haveuse-chargeuse (100) à supporter.
  8. Haveuse-chargeuse (10) selon l'une quelconque des revendications précédentes, le au moins un composant de haveuse-chargeuse est au moins l'un du groupe de composants comprenant un moteur de roulage (100), une commande motrice configurée pour faire tourner le au moins un bras de réglage, une commande motrice configurée pour faire pivoter le au moins un tambour de coupe (40, 45) et une armoire de commande électrique.
  9. Haveuse-chargeuse (10) selon l'une quelconque des revendications précédentes, le au moins un composant de haveuse-chargeuse (100) ayant une masse d'au moins 200 kg, de préférence de plus de 400 kg ou de 500 kg.
  10. Haveuse-chargeuse (10) selon l'une quelconque des revendications précédentes, le au moins un composant de haveuse-chargeuse (100) ayant une longueur d'au moins 500 mm, en particulier de plus de 800 mm, et/ou un diamètre d'au moins 200 mm, en particulier de plus de 350 mm.

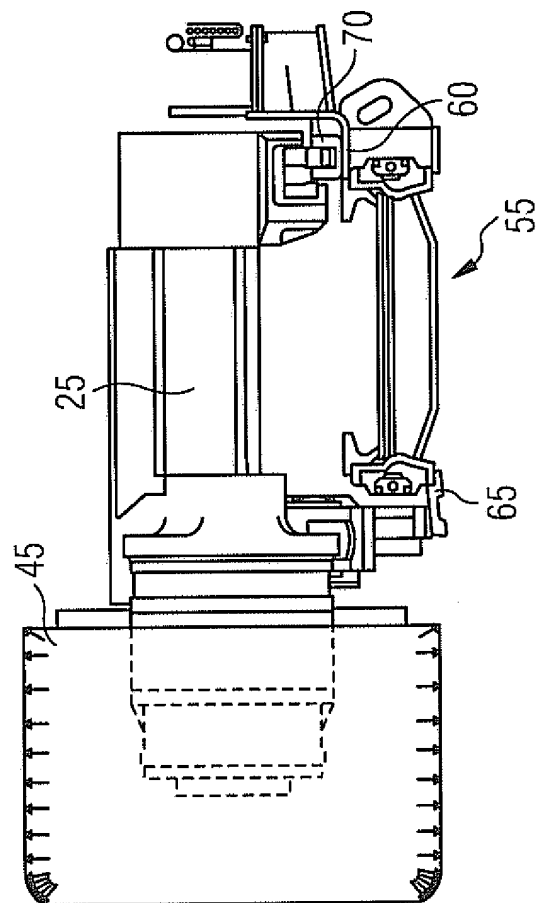
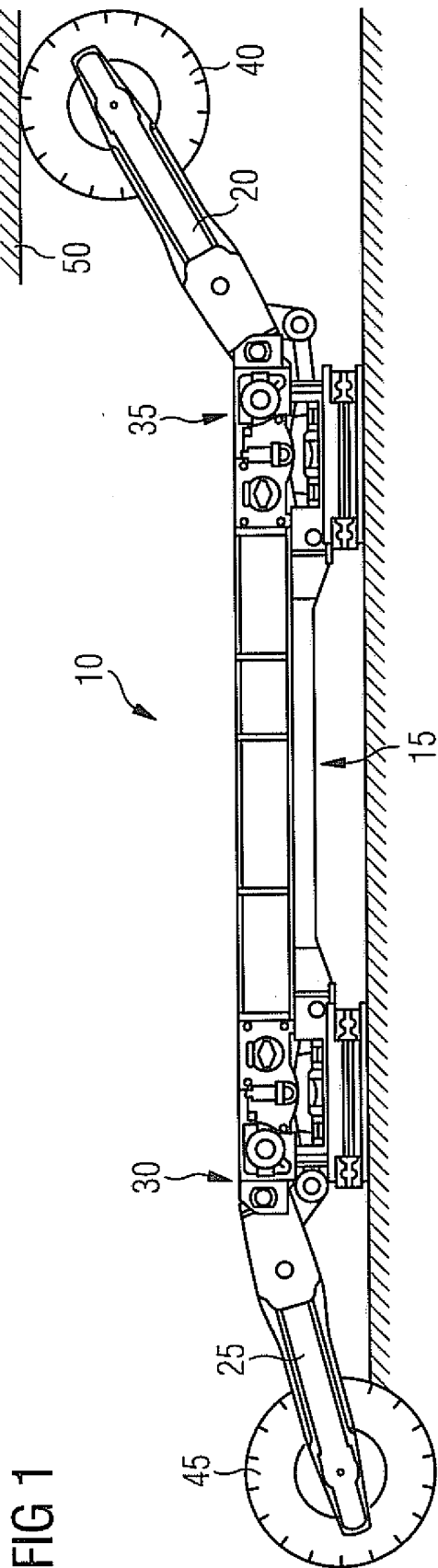


FIG 3

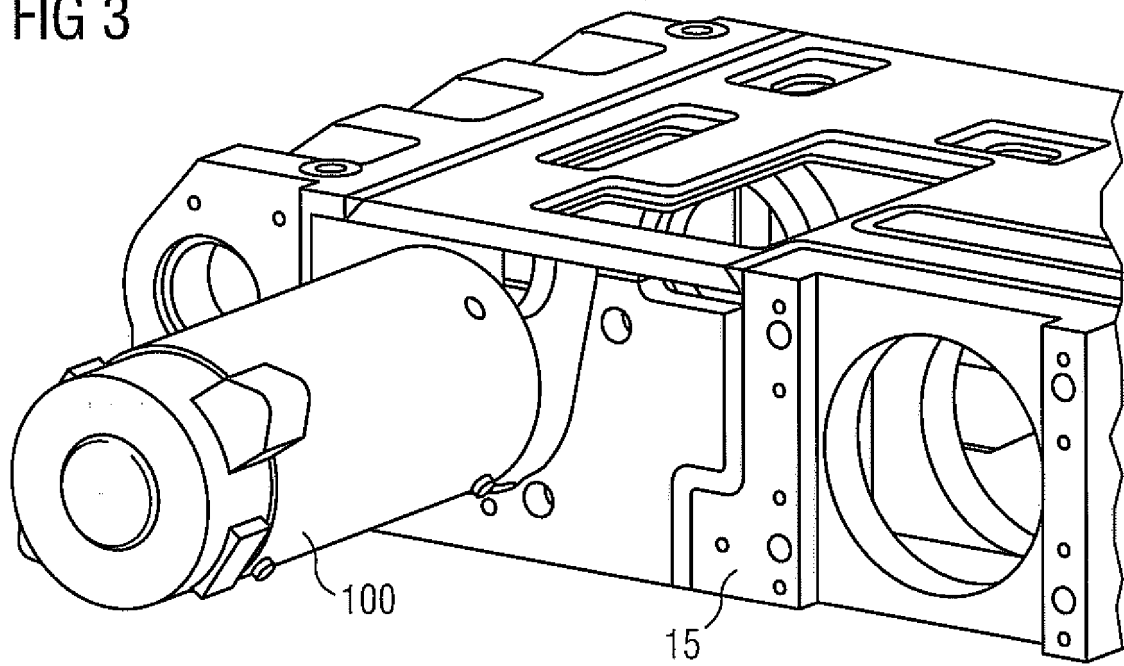


FIG 4

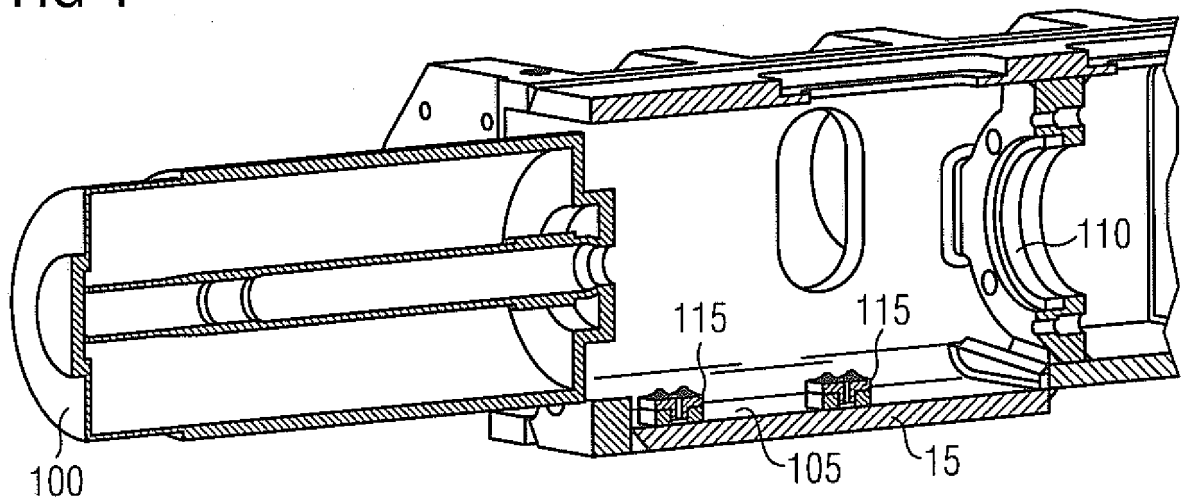


FIG 5

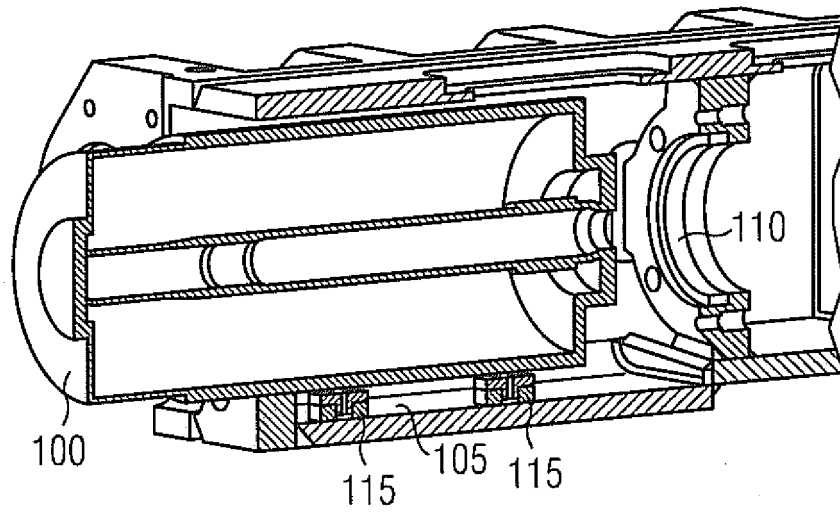


FIG 6

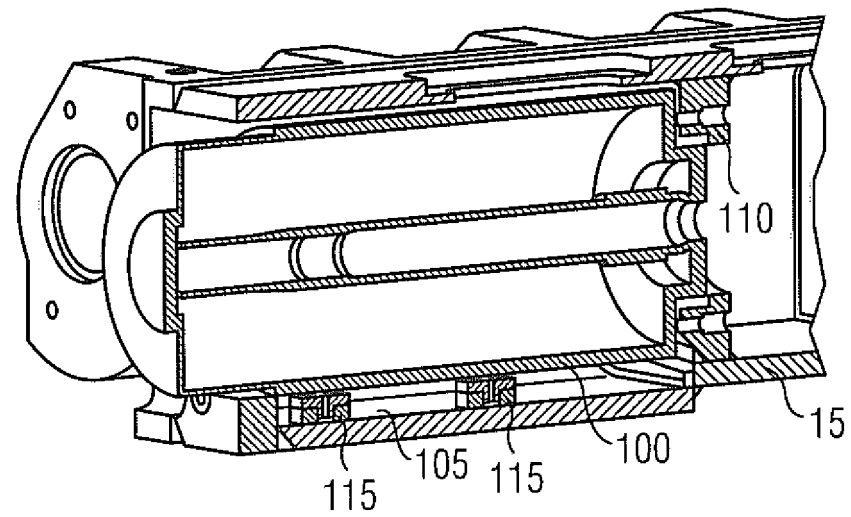


FIG 7

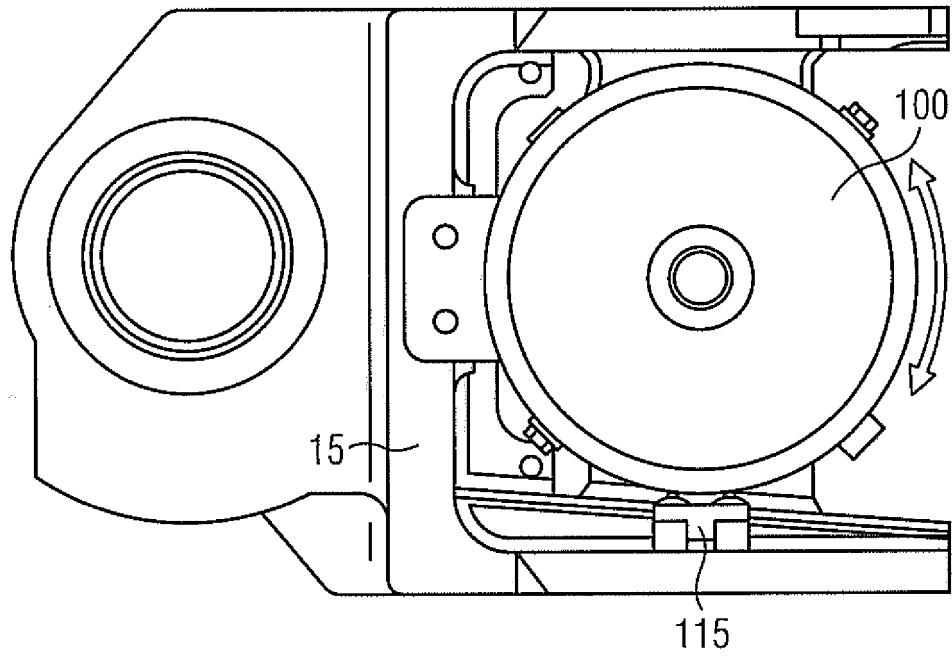


FIG 8

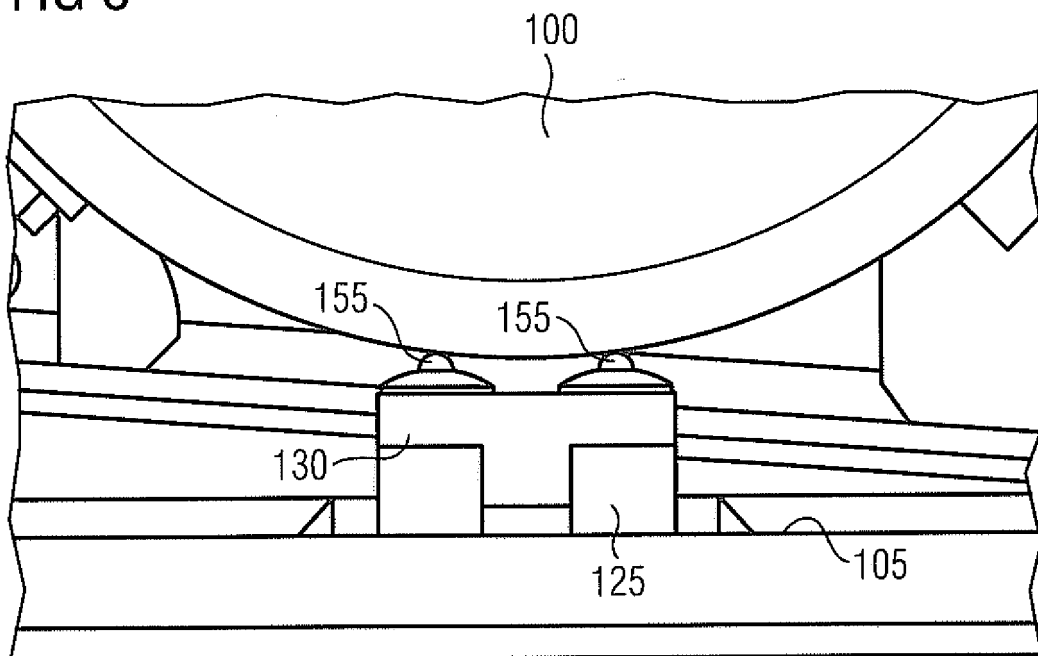


FIG 9

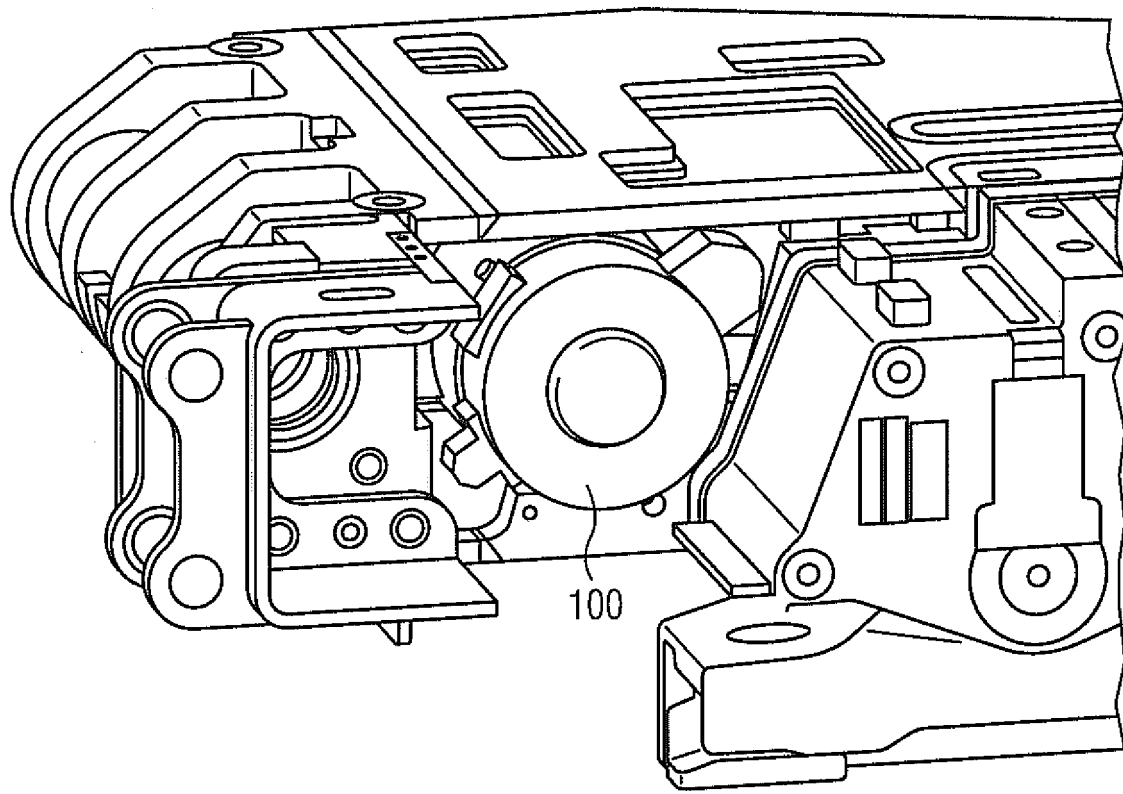


FIG 10

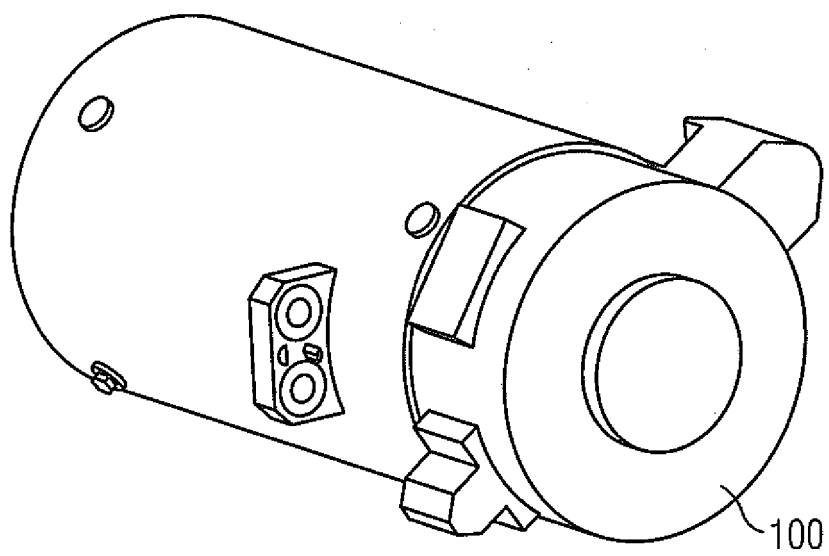


FIG 11

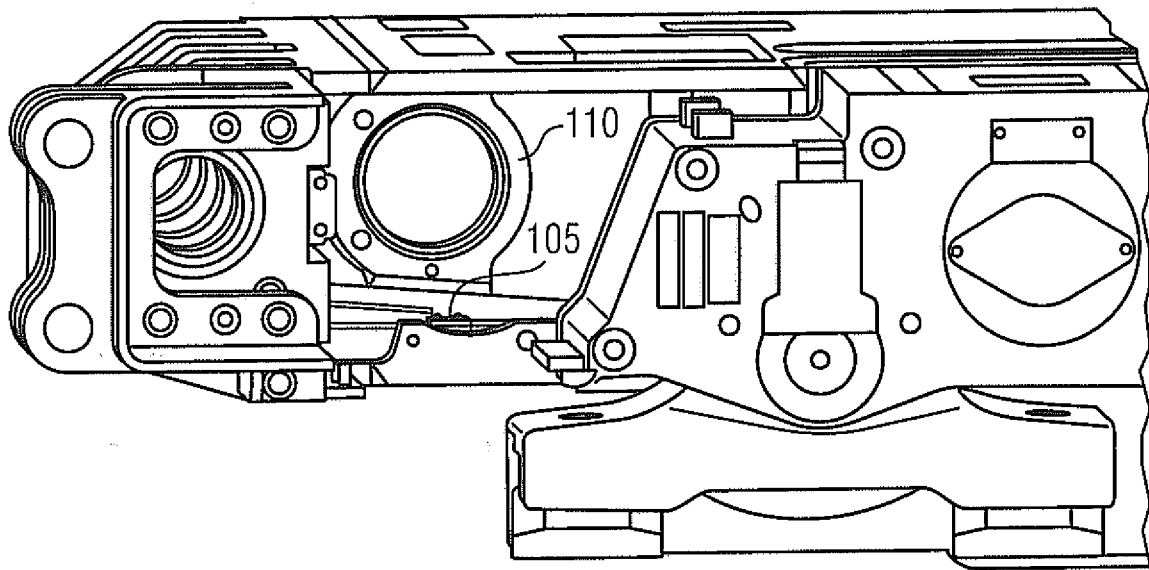


FIG 12

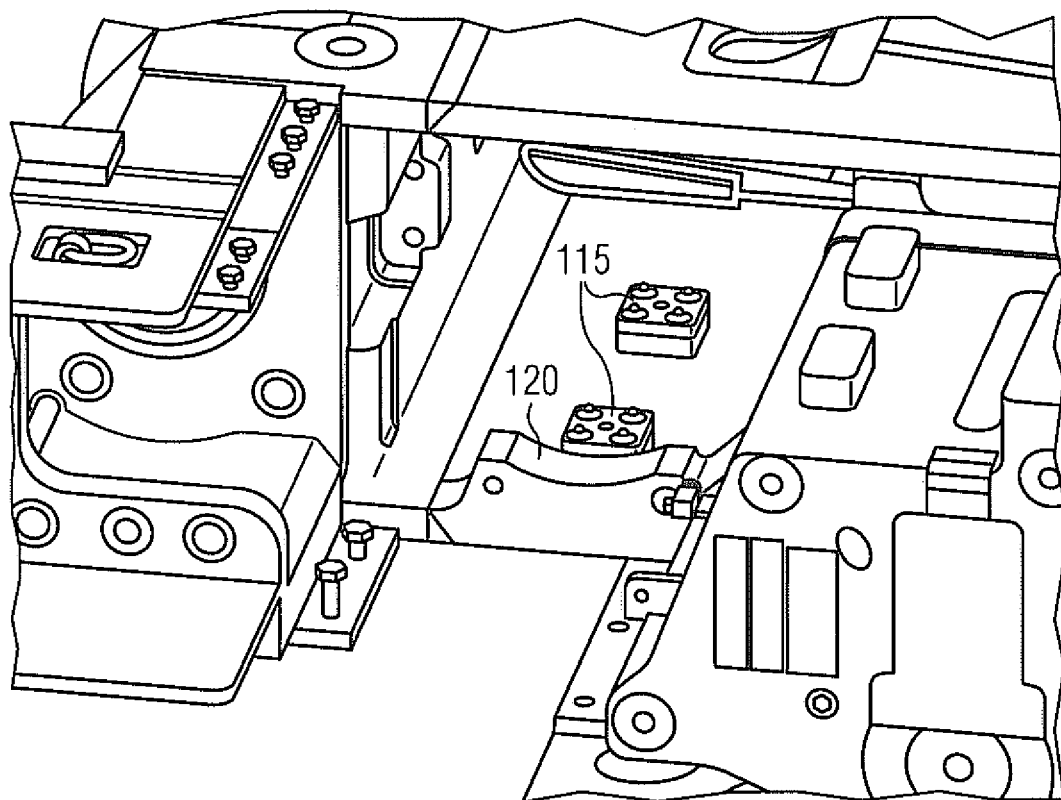


FIG 13

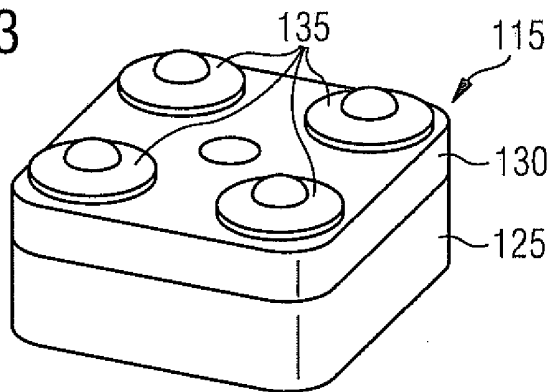


FIG 14

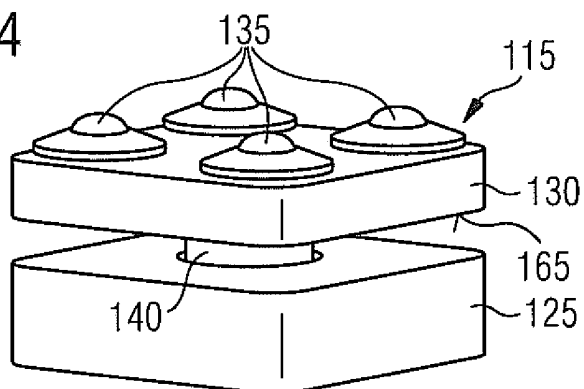


FIG 15

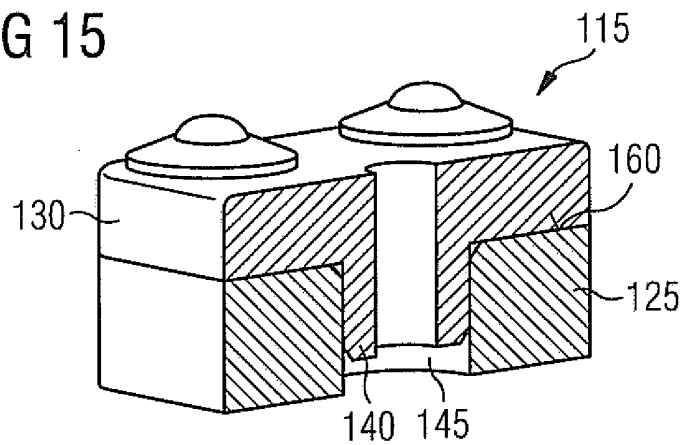
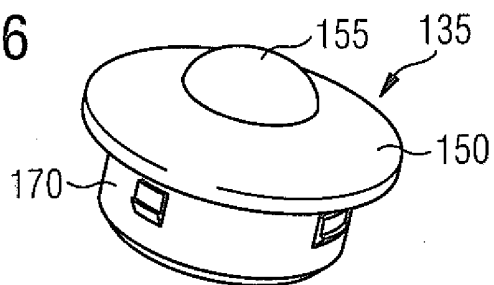


FIG 16



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- US 7954904 B2 [0003]
- US 20120267940 A1 [0003]
- AU 8382091 B [0003]