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(71) Applicant: **Construcciones Mecánicas Llamada, S.L.**
08440 Cardedeu (ES)

(72) Inventor: **HERRERO CODINA, Juan Vicente**
CARDEDEU (ES)

(74) Representative: **Ponti & Partners, S.L.P**
C. de Consell de Cent 322
08007 Barcelona (ES)

(54) GEAR REDUCER MECHANISM OF AN AUGER FOR SURFACE-DRILLING RIGS

(57) The present invention relates to a gear reducer mechanism of an auger for surface-drilling rigs, commonly used in the construction of piles, which rotates an auger, via motorised means, to achieve said drilling of the surface on which the auger strikes. This gear reducer mechanism has, advantageously, a configuration that includes at least one auger fixing hole with rotary movement and with longitudinal movement with respect to the rotary transmission part, an end-of-stroke piece of the maximum longitudinal displacement of the fixing hole and a stop of the auger fixing hole that comes into contact with the end-of-stroke piece when the maximum relative longitudinal displacement is reached, wherein this configuration allows to create jumps that cause the fixing hole of the auger to transmit to the auger itself a hammering movement against the ground to be drilled.

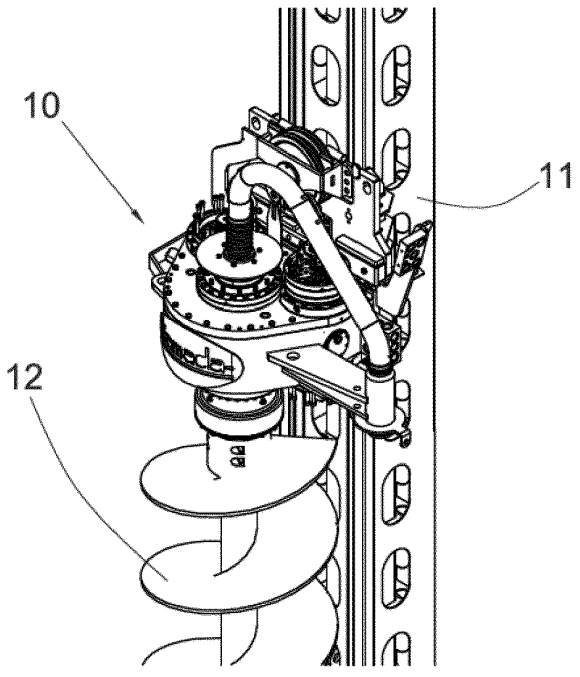

Fig. 1

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Description

[0001] The present invention relates to a gear reducer mechanism of an auger for surface-drilling rigs, commonly used in the construction of piles, which rotates an auger, via motorised means, to achieve said drilling of the surface on which the auger strikes.

Background of the invention

[0002] In construction activities it is usually necessary to drill land with drilling rigs to make piles or other types of drilling, taking into account that certain lands or surfaces may have layers to be drilled with the auger that have a hardness higher than the usual soil and gravel, and may include concrete or compact stone.

[0003] In order to solve this, up until now the hammering system of the auger has been used, along with various auger tips to be able to drill the stone or concrete.

[0004] In this way, mechanisms in the drilling rigs' augers that incorporate a hydraulic or pneumatic system to hammer the auger into the layer of ground to be drilled are known and, therefore, are part of the state of the art, having a hammering effect.

[0005] These known systems have several drawbacks, such as the difficulty of applying the pneumatic/hydraulic hammer function to the auger, having to bring the air/water supply under pressure to the auger head, with the corresponding technical difficulty, or having the hammering movement and function in the upper part of the auger.

Description of the invention

[0006] The gear reducer mechanism of an auger for surface-drilling rigs described in the present invention enables the mentioned inconveniences to be solved, presenting other advantages that will be described below.

[0007] The present invention is based on a gear reducer mechanism of an auger that is installed in the leader arm of a drilling rig, acting as a fixing element of the auger, as well as a driving medium that generates the rotation of said auger, with what could, in the present description, similarly be called a motor reducing mechanism. Advantageously, said gear reducer mechanism has a mechanical hammer system, which does not use a pneumatic or hydraulic system for the hammering movement of the auger.

[0008] The basic operation of the gear reducer mechanism is based on the fact that the rotation movement of the auger is generated by motorised means and taken to the auger by transmission means, usually by the gear of existing crowns/pinions, i.e. reducers, between said motorised means which generate the rotating movement of the auger and the auger itself, which is fixed to the fixing hole of the auger in the reducer. In the present invention, this fixing hole has a relative longitudinal movement with respect to the element that transmits the rotation from the means of generating the rotating movement, i.e., the rest of the gear reducer mechanism that surrounds said fixing hole of the auger, without said motorised means having to be moved, wherein the fixing hole has said relative longitudinal displacement with the rest of the gear reducer mechanism maintaining the traction of rotation that said jacketing transmits to it.

[0009] To do this, it is preferable to include a jacketing of the auger's own fixing hole, so that said jacketing is fixed to the transmission means in solidarity and turns with them, and the jacketing piece transmits the rotary movement to the auger's fixing hole, allowing said transmission contact to be maintained even though it has a relative displacement between both: the jacketing piece that transmits the rotation to the fixing hole, and the fixing hole itself.

[0010] Alternatively, the action can be performed without a jacketed piece, by having the relative movement between the fixing hole, and directly the means of transmitting the turn.

[0011] The longitudinal relative displacement of the auger fixing hole is made by the increase in the hardness of the material to be drilled, in such a way that by pressing the gear reducer mechanism, when it is moved in the direction of drilling, towards the auger, which finds it more difficult to drill, this auger does not advance downwards in its drilling, the gear reducer mechanism descends more than the auger and, therefore, this relative displacement is automatically created between the gear reducer mechanism surrounding the auger fixing hole and the auger fixing hole, when the material to be drilled is of greater resistance than the downward force exerted by the reducer and the auger.

[0012] Said longitudinal displacement between the fixing hole and the gear reducer mechanism surrounding this fixing hole has a delimitation of the maximum longitudinal stroke that can be made, with an end-of-stroke piece on this fixing hole being included in the structure of the gear reducer mechanism that surrounds the fixing hole. On the other hand, the auger fixing hole has a stop that comes into contact with the end-of-stroke piece preventing its longitudinal displacement and turning said stop together with the auger fixing hole, with respect to the end-of-stroke piece.

[0013] In an advantageous way, the gear reducer mechanism incorporates in the two pieces that limit the longitudinal displacement, the end-of-stroke piece and the auger fixing hole stop, means of generating jumps between these two surfaces that are in contact due to the resistance involved in the drilling. Preferably, these means of generating jumps between the surface of the stop of the fixing hole against the surface of the end-of-stroke piece will be formed by irregularities, teeth, protuberances, etc., between these two surfaces, which form small sudden longitudinal relative displacements between the fixing hole and the auger itself, with which the auger exerts a hammering effect against the land to be drilled.

[0014] In order to avoid the transmission of the vibrations caused by this hammering effect on the auger and reducer assembly to the rest of the drilling machine, means of vibration absorption are available between the guide tower and said gear reducer mechanism.

[0015] Thus, the gear reducer mechanism of an auger for surface-drilling rigs has, advantageously, a configuration that includes at least one auger fixing hole with rotary movement transmitted from the motorised means and with longitudinal movement with respect to the rotary transmission part; an end-of-stroke piece of the maximum longitudinal displacement of the fixing hole that is located in the parts of the mechanism that surround the fixing hole of the auger; and a stop of the auger fixing hole that comes into contact with the end-of-stroke piece when the maximum relative longitudinal displacement is reached between the fixing hole and the rest of the structure of the gear reducer mechanism that surrounds it; wherein, when the material to be drilled shows a resistance to drilling greater than that of the drilling force exerted by the gear reducer mechanism with the auger, said auger does not advance towards the interior of the material and the gear reducer mechanism that surrounds it moves in the direction of the drilling, producing the relative displacement between the fixing hole and the rest of the gear reducer mechanism that surrounds it, moving relatively between them until its maximum displacement is reached, at the point of contact between the end-of-stroke piece and the stop piece of the auger fixing hole, and wherein the contact surface of the end-of-stroke piece and the stop piece of the auger fixing hole have protuberances, teeth or similar, which when rotating one against the other at said maximum displacement point, create jumps that cause the fixing hole of the auger to transmit to the auger itself a hammering movement against the ground to be drilled.

[0016] With all the above, a mechanical hammer system is achieved in the auger with a minimum modification of the gear reducer mechanism, and taking advantage of the weight of the auger leader arm itself, as well as doing away with complicated installations such as hammering by pneumatic or hydraulic systems, which are expensive to produce and maintain, requiring a greater reducing motor power, and without said hydraulic or pneumatic systems obtaining greater effectiveness than the mechanical system proposed in the present invention.

Brief description of the drawings

[0017] In order to better understand the description made, a set of drawings has been provided which, schematically and solely by way of non-limiting example, represents a practical storage case of embodiment.

Figure 1 is a perspective view of the gear reducer mechanism installed in the drill leader arm with the auger installed in the fixing hole.

Figure 2 is a cross-section view of the reducer with a jacket around the fixing hole.

Figure 3 is a cross-section view of the reducer without a jacket around the fixing hole.

Figure 4 is a cross-section view of detail "A" corresponding to the displacement stop and hammering surfaces.

Description of a preferred embodiment

[0018] In the present preferred embodiment of the invention, the gear reducer mechanism (10) to provide torque to a surface drilling auger (12) is installed in the guide tower (11) of a land drill rig and to which that drill auger (12) is fixed.

[0019] The gear reducer mechanism (10), as can be seen in Figures 1 to 3, has motorised means (13) for generating the rotary movement which are transmitted by means of pinions (14) up until the part which surrounds, as a jacket (15), the fixing hole (16) of the auger (12). This jacket (15) fits with the rotating movement transmission pinions (14), transmitting in turn said movement to the fixing hole (16) that it surrounds, but having some holes (17) that allow the relative longitudinal displacement between the fixing hole (16) and the jacket (15) that is connected in solidarity with the rest of the gear reducer mechanism (10).

[0020] This relative longitudinal displacement between the fixing hole (16) and the jacket (15) which is connected with the rest of the gear reducer mechanism (10), is produced by the increase in the resistance of the ground being drilled, in such a way that the force exerted by the gear reducer mechanism (10) with the auger (12) on the ground is not sufficient to advance in the direction of drilling and then the gear reducer mechanism (10) moves in said direction while the auger (12) cannot.

[0021] This longitudinal displacement has a maximum, limited by a piece of maximum displacement (18) in solidarity with the reducing mechanism (10), which interposes itself in the way of a stop (19) located in solidarity with the fixing hole (16) of the auger (12), colliding in order to limit said longitudinal displacement. As mentioned above, the stop (19) of the fixing hole (16) is connected to it, thus maintaining the same rotation as the fixing hole (16) and the auger (12) that is fixed. Both parts, the stop (19) of the fixing hole (16) and the maximum moving part (18) can form part of the elements to which they are attached or, as in this preferred embodiment, be parts that are interchangeable for reasons of maintenance or modification.

[0022] The surface (20) of the maximum longitudinal displacement part (18) that comes into contact with the surface (21) of the stop (19) of the fixing hole (16) of the auger (12), as well as this surface (21) of the fixing hole (16) stop, has inclinations, holes, protrusions, teeth, etc., wherein when it comes into contact by turning one sur-

face (20) with respect to the other (21), it produces an effect of sudden jumps during the turn, making the fixing hole (16) have small sudden, longitudinal movements and creating an effect of hammering against the ground, which occurs automatically when a greater resistance is created in the ground to be drilled.

[0023] Alternatively, as can be seen in Figure 3, the fixing hole (16) directly contacts the pinion (14) of the motorised means (13) generating the rotary motion, said pinions having a longer length by which the transmission contact piece of the rotary motion of the fixing hole moves longitudinally, through said pinion of the rotary motion transmission means, until it is limited, as is done in the preferred embodiment described above.

[0024] Between the guide tower (11) and said gear reducer mechanism (10) there are vibration absorption elements, not shown in the figures, to avoid the transmission to the rest of the drilling machine of the vibrations caused by this hammering effect in the auger (12) and reducer (10) assembly.

[0025] Although reference has been made to a specific embodiment of the invention, it is clear to a person skilled in the art that the gear reducer mechanism of an auger for surface-drilling rigs described is susceptible to numerous variations and modifications, and that all the details mentioned can be substituted by other technically equivalent ones, without departing from the scope of protection defined by the attached claims.

Claims

1. Gear reducer mechanism of an auger for surface-drilling rigs which makes the auger (12) that is connected with said mechanism (10) turn by motorised means (13) that transmit the rotary movement to this auger (12), **characterised in that** the gear reducer mechanism (10) is formed, at least, by:

    - an auger fixing hole (16), which in addition to the rotary motion transmitted from the motorised means (13), has relative longitudinal motion with respect to the element transmitting the rotation (14), without affecting the position of the rotary transmission element (14) that does not move longitudinally;
    - an end-of-stroke piece (18) of the maximum longitudinal displacement of the fixing hole (16), which is located in the parts of the mechanism that surrounds the fixing hole (16) of the auger (12);
    - a stop (19) located at the fixing hole (16) of the auger (12) that comes into contact with the end-of-stroke piece (18), when the maximum relative longitudinal displacement is reached between the fixing hole (16) and the rest of the gear reducer mechanism (10) that surrounds it;

    wherein, when the material to be drilled shows a resistance to drilling greater than that of the drilling force exerted by the gear reducer mechanism (10) with the auger (12), said auger (12) does not advance towards the interior of the material and the gear reducer mechanism (10) that surrounds it (12) moves in the direction of the drilling, producing the relative displacement between the fixing hole (16) and the rest of the gear reducer mechanism (10) that surrounds it (16), moving relatively between them until its maximum displacement is reached, at the point of contact between the end-of-stroke piece (18) and the stop piece (19) of the auger fixing hole (16), and wherein the contact surface (20) of the end-of-stroke piece (18) and the stop piece (19,21) of the auger fixing hole (16) have protuberances, teeth or similar, which when rotating one (20) against the other (21) at said maximum displacement point, create small longitudinal displacements, by way of sudden jumps between these surfaces (20,21), which make the auger fixing hole (16) transmit to the auger (12) itself a hammering movement against the ground to be drilled.

2. Gear reducer mechanism of an auger for surface-drilling rigs according to claim 1, wherein between the transmission element (14) of the rotary movement of the motorised means (13) to the auger fixing hole (16), there is a jacket/sleeve (15) for the fixing hole (16) which transmits the rotary movement of the crown or pinion (14) to the fixing hole (16) without having longitudinal displacement, and allowing in its interior the longitudinal displacement of the auger fixing hole (16).

3. Gear reducer mechanism of an auger for surface-drilling rigs according to claim 1, wherein the transmission element (14) of the rotary motion of the motorised means (13) directly transmits the rotary motion to the auger fixing hole (16), also allowing the longitudinal displacement of the auger fixing hole (16) by said movement transmission system (14) when the contact piece of the rotary motion transmission of the fixing hole moves, by the crown or pinion (14) of the transmission means (13) of the rotary motion.

4. Gear reducer mechanism of an auger for surface-drilling rigs according to claim 1, wherein the stop (19) of the fixing hole (16) is connected and forms part of the fixing hole (16) itself by coming into contact with the maximum longitudinal displacement piece (18) which is connected and forms part of the structure of the gear reducer mechanism (10).

5. Gear reducer mechanism of an auger for surface-drilling rigs according to claim 1, wherein the stop (19) of the fixing hole (16) is connected and consists

of an interchangeable piece coming into contact with the maximum longitudinal displacement piece (18) that is connected with the structure of the gear reducer mechanism (10), also being interchangeable.

6. Gear reducer mechanism of an auger for surface-drilling rigs according to claim 1, wherein between the guide tower (11) and said gear reducer mechanism (10) are arranged elements to absorb the vibration of the hammering effect in the auger (12) and reducer assembly.

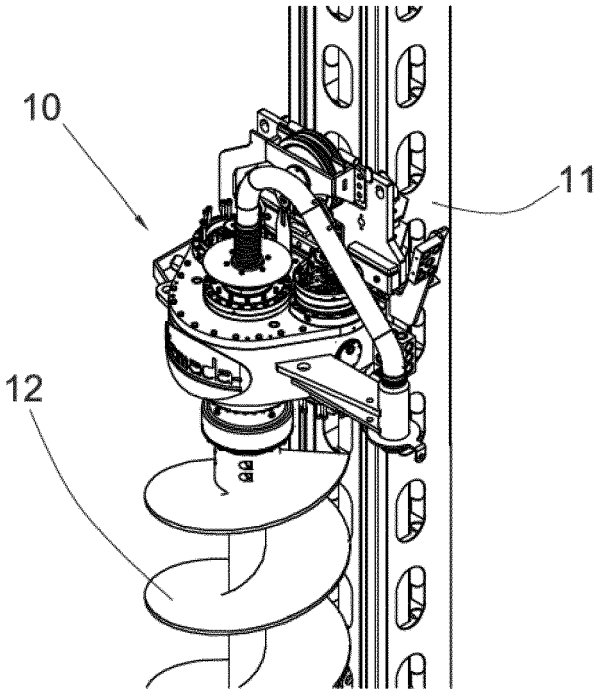

Fig. 1

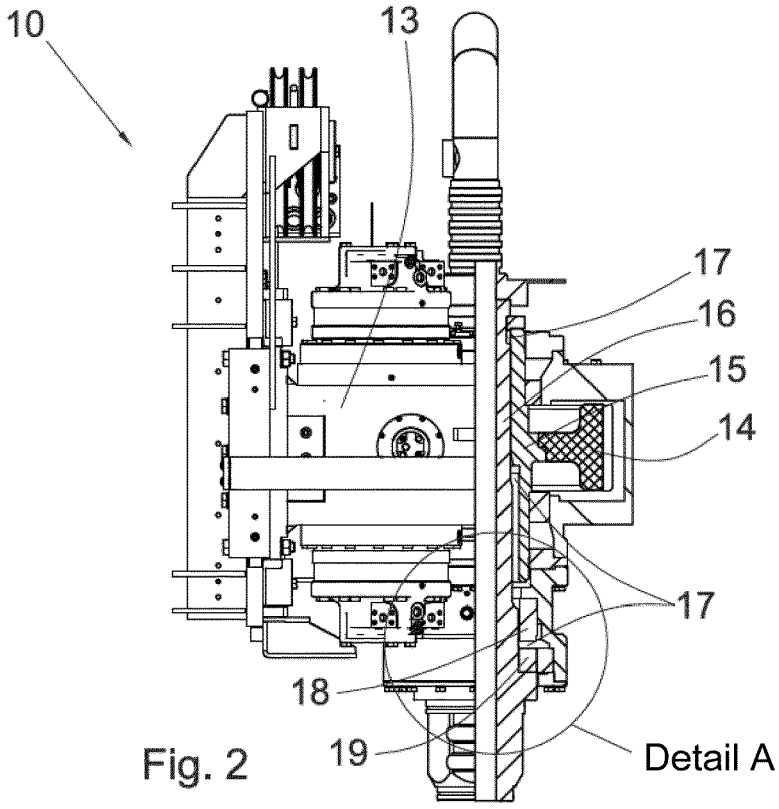

Fig. 2

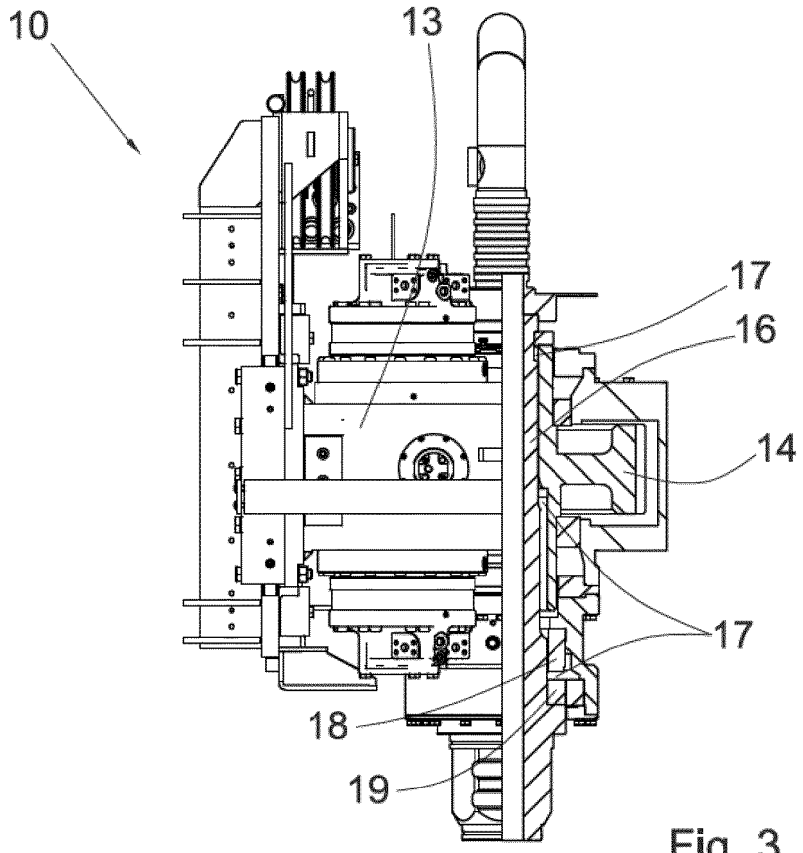

Fig. 3

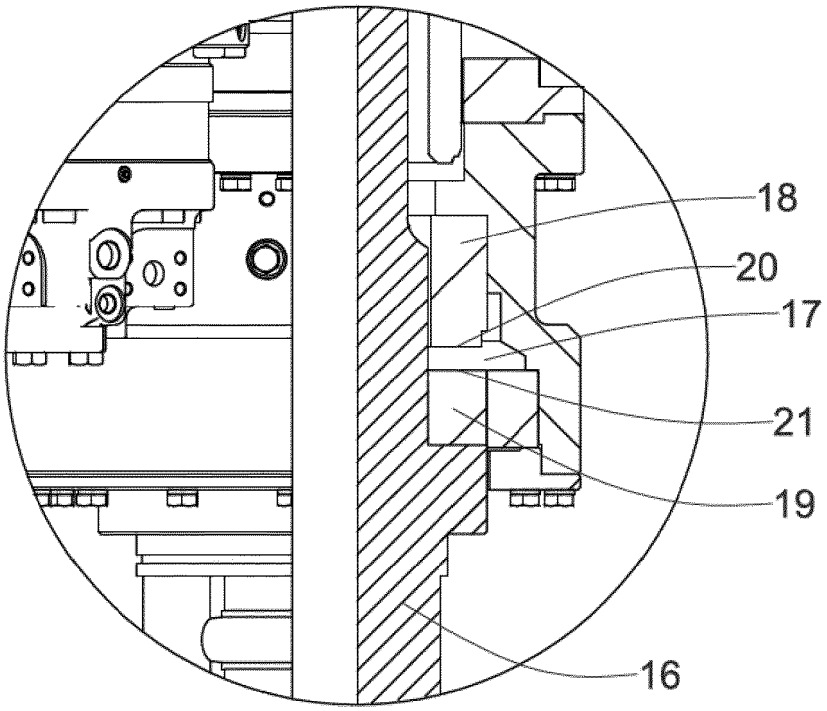

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 9512

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	WO 2017/056026 A1 (MCMILLAN JARON LYELL [NZ]) 6 April 2017 (2017-04-06) * page 11, line 10 - page 14, line 8; figures 1-7 *	1-6	INV. E21B3/02 E21B4/08 E21B6/02 E21B1/02 E21B7/00 E21B10/44
A	US 5 531 278 A (LIN PI-CHU [TW]) 2 July 1996 (1996-07-02) * column 3, line 1 - line 10; figure 1 *	1-6	
A	US 2016/040528 A1 (BENSON TODD W [US] ET AL) 11 February 2016 (2016-02-11) * paragraph [0062] - paragraph [0066]; figure 1 *	1-6	

TECHNICAL FIELDS SEARCHED (IPC)

E21B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 August 2019	Strømmen, Henrik

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 16 9512

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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21-08-2019

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