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(54) **PILE CROPPER**

PFAHLSCHNEIDER

COUPEUR DES PIEUX

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(73) Proprietor: **Astra Site Services Limited**

Bathgate, Lothian EH48 2FH (GB)

(72) Inventor: **RODGERS, Simon**

Bathgate

Lothian EH48 2FH (GB)

(74) Representative: **Tevlin, Christopher Michael et al**

Marks & Clerk LLP

1 New York Street

Manchester M1 4HD (GB)

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Description

[0001] This invention relates generally to the cropping of concrete piles, such as generally known from GB 247 0 364 A and used in the construction of buildings, after they have been cast in order to reveal the internal reinforced steel rods set within the concrete cladding. More specifically, although not exclusively, this invention relates to an improvement in apparatus used in the cropping of concrete clad piles to reveal the said internal reinforcement steel rods set within.

[0002] In the erection of modern buildings, there is a requirement for the use of foundations. One type of foundation, commonly used on areas of reclaimed land, is the well-known reinforced concrete pile. Two types of reinforced concrete pile prevail, namely those cast in situ or otherwise, pre-cast. Pre-cast concrete piles are made intentionally to protrude from the ground in which they are positioned to give satisfactory space for levelling to a required level. Levelling is done by cropping the top of the pile to a required height. The concrete piles also contain steel reinforcing rods which need to be exposed in order that further building works can be structurally tied to the foundations. The need for these reinforcing rods mean that any cropping to the concrete needs to avoid severing the pile all the way through. Devices to crop need to fracture the concrete at a localised point and then remove the waste, or facilitate its removal to reveal a section of reinforcing rod.

[0003] Cropping devices are well known in the industry, such as that disclosed in EP0339261, a device lowered over the concrete pile to a desired height and whose cutting teeth fracture the concrete. This device, and many like it, has hydraulically driven jaws that pivot about a point close to the body of the device. This drives the cutting teeth in a circular motion about said point. The concrete piles to be cropped, however, are of varying thicknesses, heights and tolerances; so any given cropping device ideally need to be able to crop a variety of concrete piles of varying size such as of varying thicknesses. If the pile is thicker than average, the jaws need to be wider whereby pressure is therefore applied in a downwards direction, i.e. at an acute angle with respect to a normal plane horizontal with respect to the vertical axis of the pile. If the pile is thinner than average, the jaws need to be narrower and the hydraulic pressure applied to the cutting teeth will be upwards i.e. at an acute angle with respect to a normal plane horizontal with respect to the vertical axis of the pile. The current cropping devices only work at their optimum efficiency with concrete piles of average thickness with very little tolerance thicker or thinner.

[0004] A disadvantage of this type of known system is that the pressure from the cutting teeth may be applied at an angle not parallel to the required fracture through the concrete, therefore wasting power. A second disadvantage of this is that the direction of applied hydraulic cutting force may not be parallel to the direction of the

cutting teeth throughout the extent of their cutting engagement with the pile; this decreases the life span of the teeth which are consumable items. The method that current cropping devices use to counteract this disadvantage is to lengthen the distance between the centre of rotation and the cutting teeth. The problem with this is that the mechanical force decreases due to the pivot effect created between the pneumatic piston, the centre of rotation and the cutting tooth. The current cropper design therefore makes a compromise between these disadvantages.

[0005] It is an object of this invention to provide a pile cropping device wherein power applied by the cutting teeth remains substantially parallel to the desired plane of fracture in the concrete pile. It is another object to provide a pile cropping which allows utilisation of the pivot effect inherent in a typical pile cropping system to utilise the hydraulic more economically. It is yet another object to provide a pile cropping device that directs a cutting force generally parallel to the position of the cutting teeth and independently of the thickness of the pile to be cropped to optimise integrity and longevity of each tooth.

[0006] According to the present invention, there is provided a pile cropping device comprising a body locatable around and/or in the region of a pile to be cropped, the body having one or more pile cropping teeth adapted, in use, to engage with and disengage from cladding and/or reinforcement of said pile, wherein at the point of engagement between the cropping tooth or teeth and the pile to be cropped, the planar orientation of the tooth or teeth relative to the axis of the pile remaining generally unaffected by variation in the thickness of said reinforcement and/or cladding to be cropped from the pile. Preferred and optional features are to be found amongst the sub claims herewith.

[0007] In one embodiment the device for cropping concrete pile foundations comprises a body for receiving the exposed top of the concrete pile, means for attachment to lifting apparatus, at least one cutting tooth in a hydraulically powered jaw including a parallel linkage to maintain the position of the tooth generally parallel to a desired plane of fracture in the concrete pile.

[0008] In a second embodiment, the device for cropping concrete pile foundations comprises one cutting tooth for which there is provided a surface, oppositely located relative to the tooth to provide a contact point for the tooth to push upon when in operation.

[0009] In a third embodiment, the device for cropping concrete pile foundations comprises more than one cutting tooth in which an array of similar teeth and mountings therefor is arranged at even spacing around the body to provide even cutting or cropping power distribution into the concrete pile when in operation.

[0010] In a still further embodiment of the invention, the device for cropping concrete piles comprises, a body, at least one hydraulically actuated jaw rotationally connected to a pivot point on the body, comprising at least one cutting tooth, the jaws of the pile cropping device

containing a parallel linkage between a centre of rotation of the jaw, and a cutting tooth. The pivot point on the body, rotationally connected to the jaw, is rigidly connected to a second point, independent of the jaw, with the line that joins the two being parallel to a desired cutting plane, these two said points being rotationally connected to the cutting tooth by a central linkage and the jaw, the jaw being rotationally connected to the pivot point and to the front of the cutting tooth and the central linkage being rotationally connected to the said second point and to a point at the back of the cutting tooth. The distance between the said second point and said point at the back of the cutting tooth being the same as the distance between the centre of rotation and the point it is connected to at the front of the cutting tooth, the distance between the centre of rotation and the said second point being the same as the distance between the point at the front of the tooth and the point at the back of the tooth. These dimensional qualities hold the cutting tooth parallel to the desired cutting plane and therefore meet the requirements of the non-exclusive objects of this invention.

[0011] In order that the invention may be illustrated, more easily appreciated, and readily carried into effect by those skilled in the art, embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a side view of a pile cropping device,

Figure 2 is a cross-section of the device in figure 1,

Figure 3 is an enlarged detail view of a jaw-tooth arrangement from figure 2,

Figure 4 is an isometric view of another preferred embodiment,

Figure 5 is a side view of the embodiment shown in figure 4,

Figure 6 is a top view of the embodiment shown in figure 4,

Figure 7 is a cross-section of the device in figure 5 in an open position, and

Figure 8 is a cross-section of the device in figure 5 in a closed position.

[0012] Referring to the drawings, figure 1 is an image of one embodiment of the pile cropper device (1). The figure shows the device from the side and shows the body of the cropper (11) rotationally connected to jaws (12) at a pivot point (15). The jaws comprise of a jaw assembly (12) and cutting teeth (13). The jaws are driven by hydraulic arms (14) and the internal parallel mechanism holds the tip of the teeth parallel to the desired plane of fracture of the concrete pile (not shown) and the rota-

tion point (16) allows the tip to rotate. The jaw assembly comprises outer plates (18) and support elements (17).

[0013] Figure 2 is a cross-sectional view of the device in figure 1 and shows the internal mechanism of the parallel linkage.

[0014] Figure 3 shows a detail view of the jaw assembly (12) and demonstrates one form of preferred parallel linkage. The top link (31) between the pivot point of the jaw (15) and the rotational connection (34) is, in this case, parallel to the plane of the desired fracture of the concrete pile. The tooth (13) is held by the tooth linkage (32) which is held parallel to the top link (31) by the jaw assembly (12) and the rotating link (33). The rotating link (33) between the rotational connection (34) at the top of the linkage and the rotational connection (35) at the bottom of the linkage is rotationally connected to both the top linkage (31) and the tooth linkage (32). This causes the tooth to remain parallel when the jaw actuates.

[0015] Figure 4 shows another embodiment of the invention, the figure shows the body of the cropper (41) rotationally connected to jaws (42) at a pivot point (45). The jaws comprise of a jaw assembly (42) and cutting teeth (43). The jaws are driven by hydraulic arms (44) and the internal parallel mechanism holds the tip of the teeth parallel to the desired plane of fracture of the concrete pile (not shown),

[0016] Figure 5 shows the cropping device of figure 4 from a side view. The cropper is in its open position.

[0017] Figure 6 shows the cropping device of figure 4 from the top. The cropper is in its open position.

[0018] Figure 7 shows a cross-section of the cropping device of figure 5 and demonstrates the internal parallel mechanism for this embodiment. The jaw assembly (42) contains a similar arrangement of linkages as figure 2, however, the top linkage (71) connects the pivot point (74) directly to the body of the device. The top linkage (71) positions centre of the pivot point (74) onto the same plane as the centre of the jaw pivot point (45).

[0019] Figure 8 shows the same cross-section of the apparatus as figure 7 but it is in a closed position and demonstrates the way with which the parallel mechanism causes the tooth to remain parallel.

[0020] The principal advantage of devices according to this invention result from maintaining the orientation of the tooth relative to the pile to be, or being, cropped generally constant throughout its engagement with the pile, its cladding or its projecting reinforcement as the pile reduces in thickness by removal of a portion of mainly the concrete surround. This advantage follows through in the ability to deal similarly with piles of different thickness. By so aligning the plane of cutting teeth to the axis of the pile and keeping that generally constant maximises the efficiency of the cutting/cropping operations, reduces power consumption and optimises replaceable teeth longevity.

Claims

1. A pile cropping device (1) comprising a body (11,41) locatable around and/or in the region of a pile to be cropped, the body having one or more pile cropping jaws (12,42) attached pivotally to the body, said jaws having one or more pile cropping teeth (13,43) attached pivotally to the jaw(s) and attached pivotally to the body such that, in use, said one or more teeth (13,43) engage with and disengage from cladding and/or reinforcement of said pile, wherein at the point of engagement between the cropping tooth or teeth (13,43) and the pile to be cropped, the planar orientation of the tooth or teeth relative to the axis of the pile remaining generally unaffected by the position of the jaw (12,42) in relation to the body (11,41) and therefore by variation in the thickness of said reinforcement and/or cladding to be cropped from the pile.
2. A device (1) as claimed in claim 1, in which the means by which the pile cropping teeth (13,43) are linked to the body (11,41) is a pivot or pivots (15,34;16,35).
3. A device (1) as claimed in any preceding claim, in which the or each cutting tooth (13,42) is provided with two spaced apart pivot points (16,35) for pivotal mounting to the said body.
4. A device (1) as claimed in claim 3, in which one of said spaced apart pivot points (16) is connected to a linkage (33,73) which is linked to the body.
5. A device (1) as claimed in claim 4, wherein said linkage (33,73) is a rotational linkage.
6. A device (1) as claimed in any preceding claim, wherein the jaw (12,42) includes a parallel linkage (31,32;71,72) to maintain the said tooth or teeth (13,43) in a planar orientation.
7. A device (1) as claimed in claim 1, in which the said planar orientation of the tooth or teeth (13,43) remains generally constant over a range of its movement, in use, from engagement with the said cladding and/or reinforcement to disengagement therefrom.
8. A device (1) as claimed in any preceding claim, wherein the said planar orientation remains generally constant and is independent of the thickness of the pile to be cropped.
9. A device (1) as claimed in any preceding claim, in which the jaw (12,42) is provided and mounted for powered movement by hydraulic ram (14,44), and which jaw (12,42) comprises more than three pivot points (15,16,34,35) for movable components of the

device.

10. A device (1) as claimed in claim 9 in which there are provided five such pivot points (15,16,34,35; 45,74,75).
11. A device (1) as claimed in any preceding claim in which the body (11,41) is associated with an extension arm (71) which includes a pivot point (74) at or in the region of its extremity spaced from the said body (11,41), for a movable component (42) of the device.
12. A device (1) as claimed in any preceding claim, in which the or each cutting tooth (13,43) is provided with two spaced apart pivot points (16,35;75) for pivotal mounting to the said body.
13. A device (1) as claimed in any preceding claim, comprising at least one hydraulically actuated jaw (12,42) rotationally connected to a pivot point (15,45) on the body, the device provided with such jaws which are adapted to operate with a parallel linkage (13,32) between a centre of rotation of the jaw, and a cutting tooth (13).
14. A device (1) as claimed in any preceding claim wherein a pivot point (15) on the body (11,41), rotationally connected to a jaw (12) is rigidly connected to a second point (34), independent of the jaw, a notional line that joins the two points (15,34) being parallel to a desired cutting plane, said two points being rotationally connected to a cutting tooth (13) by a central linkage (32,33) and the jaw, the jaw being rotationally connected to the pivot point and to the front of the cutting tooth (13), and the central linkage (32,33) being rotationally connected from the said second point (34) to a secondary pivot point (35) of the cutting tooth (13).
15. A device (1) according to claim 14 wherein the distance between the said second point (34) and said secondary pivot point (35) of the cutting tooth (13) is the same as the distance between the centre of rotation and the point to which it is connected at a primary pivot point (16) of the cutting tooth, the distance between the centre of rotation and the said second point (34) being the same as the distance between the primary (16) and secondary pivot points (35) of the cutting tooth (13).

Patentansprüche

1. Pfahlschneidevorrichtung (1), beinhaltend ein Gehäuse (11, 41) welches um und/oder im Bereich eines zu schneidenden Pfahls angeordnet werden kann, wobei das Gehäuse eine oder mehrere Pfahl-

- schneideklaue(n) (12, 42) besitzt, welche schwenkbar am Gehäuse befestigt ist/sind, wobei die Klauen einen oder mehrere Pfahlschneidezahn/Pfahlschneidezähne (13, 43) besitzen, welche schwenkbar an der/den Klaue(n) befestigt sind und schwenkbar am Gehäuse in der Weise befestigt sind, dass im Gebrauch der eine Zahn oder die mehreren Zähne (13, 43) mit einer Umhüllung und/oder Verstärkung des Pfahls in Eingriff gehen oder sich davon lösen, wobei am Eingriffspunkt zwischen dem Schneidezahn bzw. den Schneidezähnen (13,43) und dem zu schneidenden Pfahl die planare Ausrichtung des Zahns oder der Zähne in Bezug auf die Achse des Pfahls allgemein durch die Position der Klaue (12, 42) in Verbindung zum Gehäuse (11,41) und folglich durch die Schwankung in der Dicke der Verstärkung und/oder Umhüllung, welche vom Pfahl geschnitten werden soll, unberührt bleibt.
2. Vorrichtung (1) nach Anspruch 1, bei welcher das Mittel, mit welchem die Pfahlschneidezähne (13, 43) mit dem Gehäuse (11, 41) verbunden sind, ein oder mehrere Schwenkzapfen (15, 34; 16,35) ist/sind.
 3. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, bei welcher der oder jeder Schneidezahn (13, 42) mit zwei voneinander entfernten Schwenkpunkten (16, 35) zur schwenkbaren Montage an dem Gehäuse versehen ist.
 4. Vorrichtung (1) nach Anspruch 3, bei welcher einer der voneinander entfernten Schwenkpunkte (16) mit einem Gestänge (33, 73) verbunden ist, welches mit dem Gehäuse verbunden ist.
 5. Vorrichtung (1) nach Anspruch 4, bei welcher das Gestänge (33, 73) ein Drehgestänge ist.
 6. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, bei welcher die Klaue (12, 42) ein paralleles Gestänge (31, 32; 71, 72) beinhaltet, um den oder die Zähne (13, 43) in einer planaren Ausrichtung zu halten.
 7. Vorrichtung (1) nach Anspruch 1, bei welcher die planare Ausrichtung des Zahns oder der Zähne (13,43) im Gebrauch im Allgemeinen konstant über eine Spanne seiner/ihrer Bewegung bleibt, vom Eingriff mit der Umhüllung und/oder Verstärkung bis zum Lösen hiervon.
 8. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, bei welcher die planare Ausrichtung im Allgemeinen konstant bleibt und von der Dicke des zu schneidenden Pfahls unabhängig ist.
 9. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, bei welcher die Klaue (12, 42) für angetriebene Bewegung durch einen Hydraulikzylinder (14, 44) bereitgestellt und montiert ist, und wobei die Klaue (12, 42) mehr als drei Schwenkpunkte (15, 16, 34, 35) für bewegliche Komponenten der Vorrichtung beinhaltet.
 10. Vorrichtung (1) nach Anspruch 9, bei welcher fünf solche Schwenkpunkte (15, 16, 34, 35; 45, 74, 75) bereitgestellt sind.
 11. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, bei welcher das Gehäuse (11, 41) mit einem Erweiterungsarm (71) assoziiert ist, welcher einen Schwenkpunkt (74) an oder in dem Bereich seines von diesem Gehäuse (11,41) entfernten Endes für eine bewegliche Komponente (42) der Vorrichtung enthält.
 12. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, bei welcher der oder jeder Schneidezahn (13, 43) mit zwei voneinander entfernten Schwenkpunkten (16, 35; 75) zur schwenkbaren Montage an dem Gehäuse versehen ist.
 13. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, beinhaltend mindestens eine hydraulisch betätigte Klaue (12, 42), welche drehbar mit einem Schwenkpunkt (15, 45) am Gehäuse verbunden ist, wobei die Vorrichtung mit solchen Klauen versehen ist, welche geeignet sind, mit einem parallelen Gestänge (13, 32) zwischen einem Drehmittelpunkt der Klaue und einem Schneidezahn (13) betrieben zu werden.
 14. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, bei welcher ein Schwenkpunkt (15) am Gehäuse (11, 41), welcher drehbar mit einer Klaue (12) verbunden ist, starr mit einem zweiten Punkt (34) verbunden ist, welcher unabhängig von der Klaue ist, wobei eine gedachte Linie, welche die beiden Punkte (15, 34) verbindet, parallel zu einer gewünschten Schneideebene ist, wobei die beiden Punkte drehbar mit einem Schneidezahn (13) durch ein mittleres Gestänge (32, 33) und die Klaue verbunden sind, wobei die Klaue drehbar mit dem Schwenkpunkt und der Vorderseite des Schneidezahns (13) verbunden ist, und das mittlere Gestänge (32, 33) drehbar von dem zweiten Punkt (34) mit einem sekundären Schwenkpunkt (35) des Schneidezahns (13) verbunden ist.
 15. Vorrichtung (1) nach Anspruch 14, bei welcher der Abstand zwischen dem zweiten Punkt (34) und dem sekundären Schwenkpunkt (35) des Schneidezahns (13) derselbe ist wie der Abstand zwischen dem Drehmittelpunkt und dem Punkt, mit welchem dieser an einem primären Schwenkpunkt (16) des Schneidezahns verbunden ist, wobei der Abstand zwischen

dem Drehmittelpunkt und dem zweiten Punkt (34) derselbe ist wie der Abstand zwischen dem primären (16) und dem sekundären Schwenkpunkt (35) des Schneidezahns (13).

Revendications

1. Dispositif d'éboutage de pilot (1) comprenant un corps (11, 41) pouvant être positionné autour, et/ou dans la région, d'un pilot à ébouter, le corps présentant une ou plusieurs mâchoire(s) d'éboutage de pilot (12, 42) rattachée(s) de manière pivotante au corps, lesdites mâchoires présentant une ou plusieurs dent(s) d'éboutage de pilot (13, 43) rattachées pivotantes à la ou aux mâchoire(s) et rattachées pivotantes au corps de sorte que, en cours d'utilisation, ladite une ou lesdites plusieurs dent(s) (13, 43) vient/viennent en prise et hors de prise par rapport à un revêtement et/ou un renfort dudit pilot, dans lequel, au niveau du point de mise en prise entre la ou les dent(s) d'éboutage (13, 43) et le pilot à ébouter, l'orientation planaire de la dent ou des dents par rapport à l'axe du pilot reste essentiellement non affectée par la position de la mâchoire (12, 42) par rapport au corps (11, 41) et par conséquent par la variation d'épaisseur dudit renfort et/ou dudit revêtement à ébouter du pilot.
2. Dispositif (1) selon la revendication 1, dans lequel le moyen grâce auquel les dents d'éboutage de pilot (13, 43) sont liées au corps (11, 41) est/sont un pivot ou des pivots (15, 34 ; 16, 35).
3. Dispositif (1) selon l'une quelconque des revendications précédentes, dans lequel la ou chaque dent de coupe (13, 42) est munie de deux points de pivot (16, 35) espacés en vue d'un montage pivotant sur ledit corps.
4. Dispositif (1) selon la revendication 3, dans lequel un desdits points de pivot (16) espacés est raccordé à une liaison (33, 73) qui est relié au corps.
5. Dispositif (1) selon la revendication 4, dans lequel ladite liaison (33, 73) est une liaison rotative.
6. Dispositif (1) selon l'une quelconque des revendications précédentes, dans lequel la mâchoire (12, 42) comprend une liaison parallèle (31, 32 ; 71, 72) afin de maintenir ladite dent ou lesdites dents (13, 43) dans une orientation planaire.
7. Dispositif (1) selon la revendication 1, dans lequel ladite orientation planaire de la dent ou des dents (13, 43) reste essentiellement constante sur une plage de son déplacement, en cours d'utilisation, à partir d'une mise en prise avec ledit revêtement et/ou

ledit renfort jusqu'à une mise hors de prise par rapport à celui-ci ou ceux-ci.

8. Dispositif (1) selon l'une quelconque des revendications précédentes, dans lequel ladite orientation planaire reste essentiellement constante et est indépendante de l'épaisseur du pilot à ébouter.
9. Dispositif (1) selon l'une quelconque des revendications précédentes, dans lequel la mâchoire (12, 42) est fournie et montée en vue d'un déplacement motorisé grâce à un béliet hydraulique (14, 44), et dans lequel la mâchoire (12, 42) comprend plus de trois points de pivot (15, 16, 34, 35) destinés à des composants mobiles du dispositif.
10. Dispositif (1) selon la revendication 9, dans lequel cinq points de pivot (15, 16, 34, 35 ; 45, 74, 75) dudit type sont fournis.
11. Dispositif (1) selon l'une quelconque des revendications précédentes, dans lequel le corps (11, 41) est associé à un bras d'extension (71), comprenant un point de pivot (74) au niveau, ou dans la région, de son extrémité espacée par rapport audit corps (11, 41), destiné à un composant mobile (42) du dispositif.
12. Dispositif (1) selon l'une quelconque des revendications précédentes, dans lequel la ou chaque dent de coupe (13, 43) est munie de deux points de pivot (16, 35 ; 75) espacés en vue d'un montage pivotant sur ledit corps.
13. Dispositif (1) selon l'une quelconque des revendications précédentes, comprenant au moins une mâchoire (12, 42) actionnée de manière hydraulique et raccordée en rotation à un point de pivot (15, 45) présent sur le corps, le dispositif étant muni de mâchoires conçues pour fonctionner avec une liaison parallèle (13, 32) entre un centre de rotation de la mâchoire et une dent de coupe (13).
14. Dispositif (1) selon l'une quelconque des revendications précédentes, dans lequel un point de pivot (15) présent sur le corps (11, 41), raccordé en rotation à une mâchoire (12), est raccordé rigide à un deuxième point (34), indépendant de la mâchoire, une ligne imaginaire qui relie les deux points (15, 34) étant parallèle à un plan de coupe souhaité, lesdits deux points étant raccordés en rotation à une dent de coupe (13) grâce à une liaison centrale (32, 33) et à la mâchoire, la mâchoire étant raccordée en rotation au point de pivot et à l'avant de la dent de coupe (13), et la liaison centrale (32, 33) étant raccordée en rotation entre ledit deuxième point (34) et un point de pivot secondaire (35) de la dent de coupe (13).

15. Dispositif (1) selon la revendication 14, dans lequel la distance entre ledit deuxième point (34) et ledit point de pivot secondaire (35) de la dent de coupe (13) est la même que la distance entre le centre de rotation et le point auquel il est raccordé à un point de pivot primaire (16) de la dent de coupe, la distance entre le centre de rotation et ledit deuxième point (34) étant identique à la distance entre les points de pivot primaire (16) et secondaire (35) de la dent de coupe (13).

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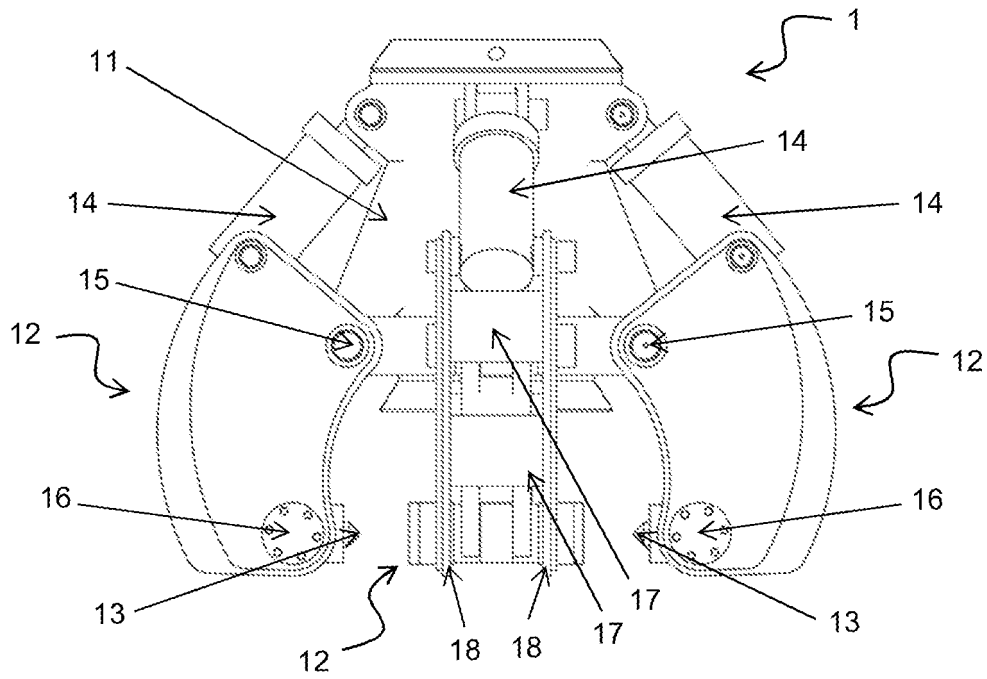


Figure 1

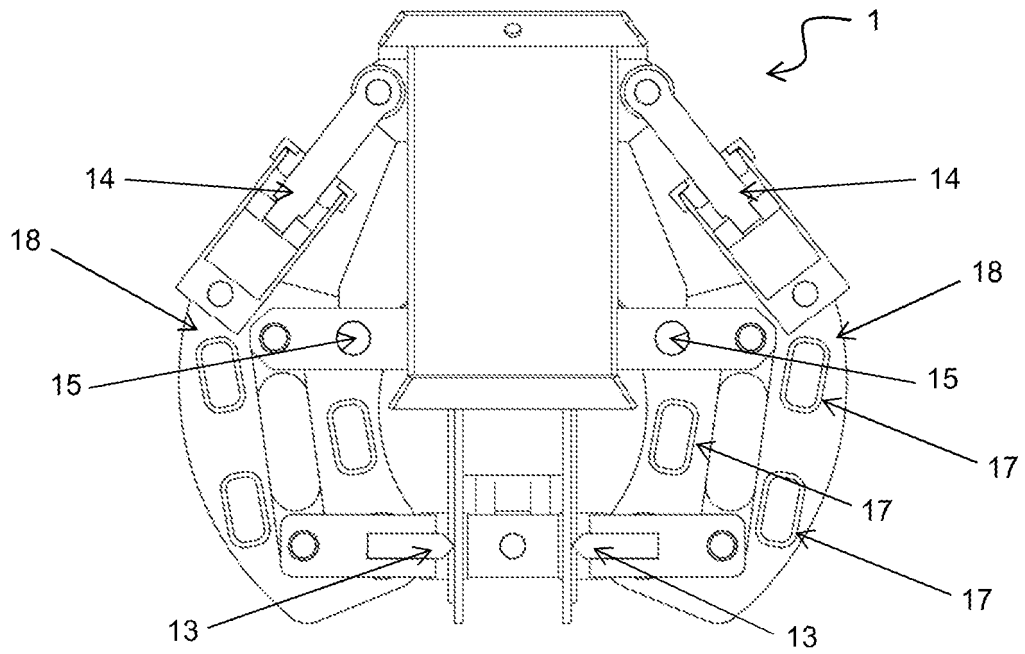


Figure 2

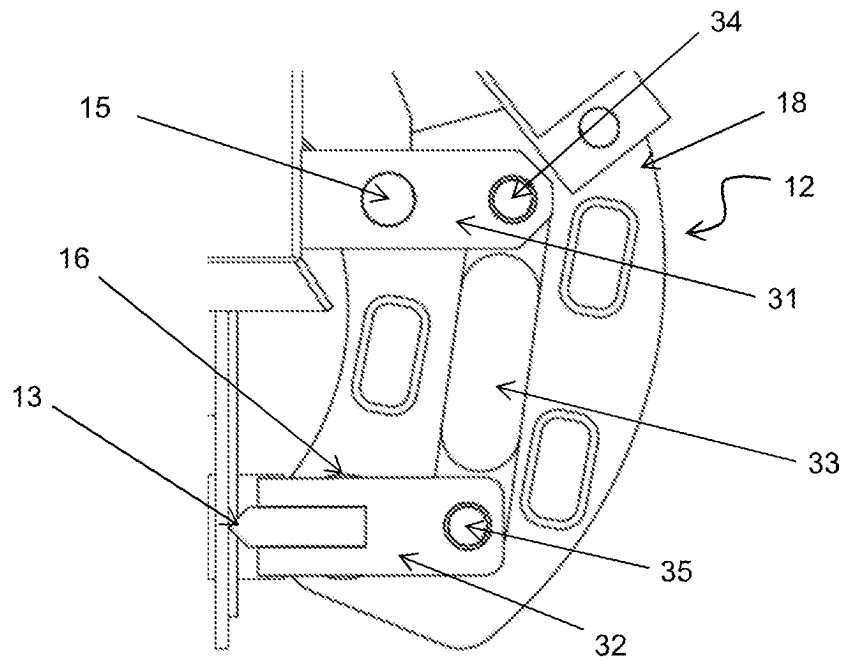


Figure 3

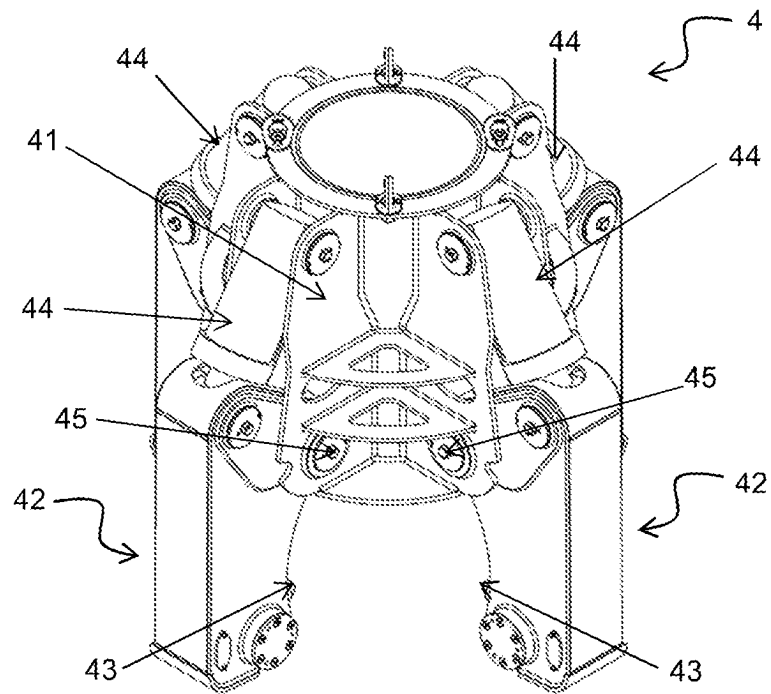


Figure 4

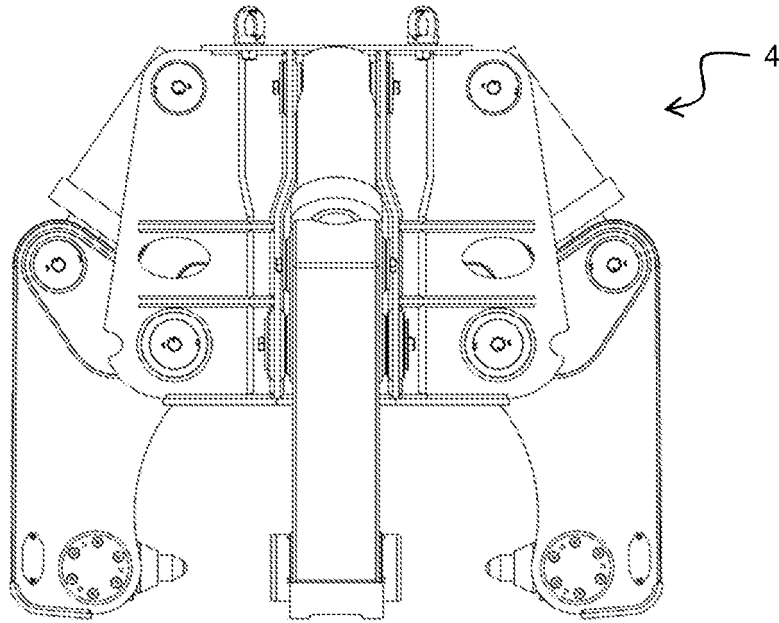


Figure 5

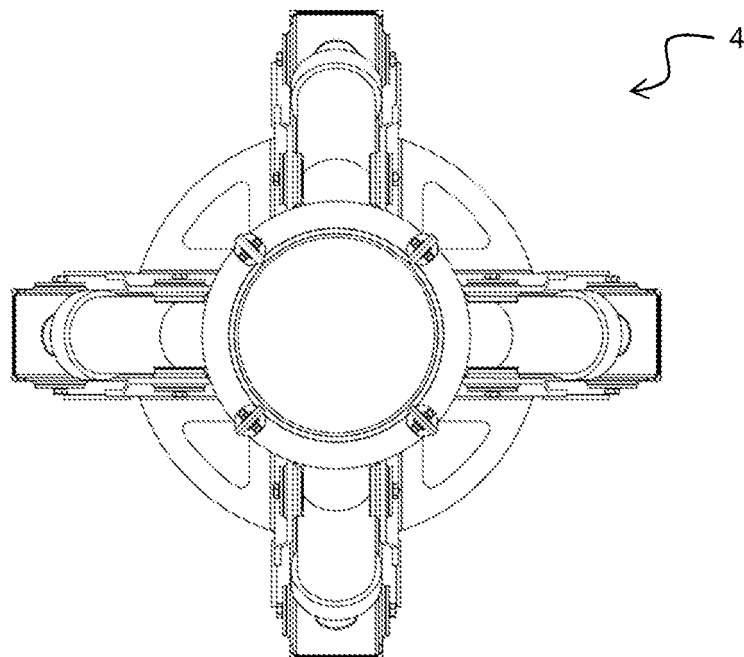


Figure 6

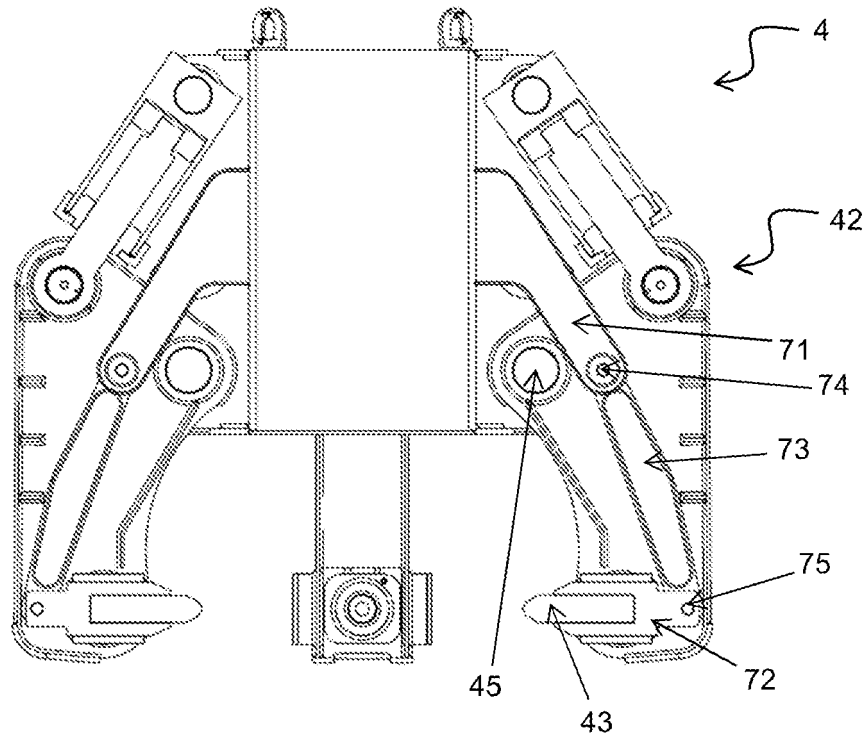


Figure 7

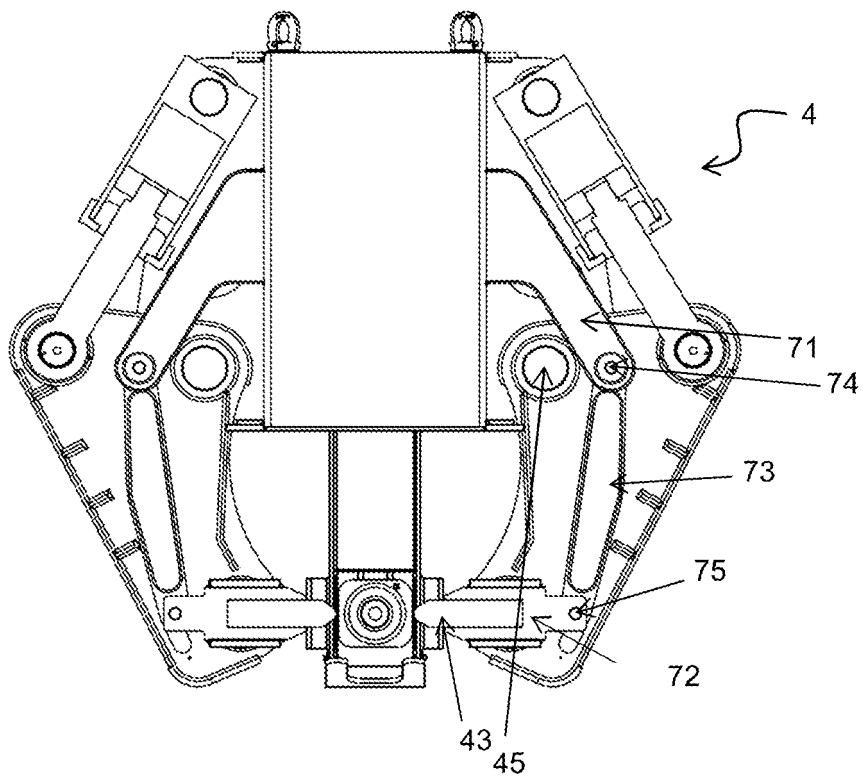


Figure 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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