Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention.)
Description

[0001] The present invention relates to a rotating head of a drilling column with clutch coupling. The drilling column is constituted by a mast of a rope hydraulic excavator or by the antenna of a tractor for realising drillings through the use of telescoping bars and various tools.

[0002] In current rotating heads the transmission of the motor moment, provided in general by hydraulic motors, at the end of the drilling column, bearing the rotating head is obtained by means of mechanical couplings (see for example US-A-4 711 310). However, the use of a mechanical coupling in a rotating head presents the drawback of entailing the restoration of the correct engagement in the transmission of the mechanical moment after the rotating column has stopped rotating. Such a stop can be consequent to the inversion of the direction of rotation of the drilling column, for instance when a fast discharge needs to be performed. To avoid this, in the past use has been made of synchronisers, with the complexities and drawbacks deriving from their employment.

[0003] The aim of the present invention therefore is to eliminate the aforementioned drawbacks.

[0004] Another aim of the present invention is to provide a rotating head with such a high speed as to discharge the tools borne by the head lacking an emptying system, such as drills, for which the detachment of the drilling material takes place using the centrifugal force created by the high speed of rotation of the tool itself once it comes out of the ground.

[0005] Yet a further aim of the present invention is to allow to operate the rotating head at all speeds clockwise or counter-clockwise, including the aforesaid fast off-loading speed, automatically allowing the operator, once the off-loading phase of the tool is complete, to resume drilling without having to worry about completely stopping the drilling column.

[0006] The invention, as it is characterised by the claims that follow, solves the problem of providing a rotating head of a drilling column with clutch coupling, which from a general point of view, is characterised in that it comprises a supporting structure circumferentially facing at least a motor group for the rotation of a sleeve of the rotating head through a crown gear, rotatably mounted on a base bearing; said at least one motor set including coaxially in cascade a hydraulic motor, a reduction set with hydraulically commended friction coupling, a pinion, connected to said reduction set and engaged with said crown gear of the support structure; wherein at least a single motor set further carries joined coaxially opposite to said first hydraulic motor, a second hydraulic motor with constant displacement and a reduction gear connected to said pinion opposite to said reduction set.

[0007] One of the advantages attained by means of the present invention is that of being able to establish, during the design phase, the drilling torque that the rotating head has to output and consequently to dimension the clutch couplings of the reduction sets. In this way, during the operative phase the established torque values are not exceeded, thereby safeguarding all mechanical and hydraulic parts involved in the operation, which lie upstream of the rotating head according to the present invention.

[0008] One of the advantages obtained by means of the present invention consists essentially of the fact that the rotating head according to the invention can allow a wide range of rotating speeds of the drilling column. A high rotating speed, for instance, is useful to discharge tools lacking emptying systems by effect of the centrifugal force.

[0009] Further features and advantages of the invention shall be made more readily apparent from the content of the detailed description that follows, of a preferred embodiment illustrated purely by way of non limiting indication in the accompanying drawings, wherein:

- Figure 1 schematically shows a partially sectioned side view of a rotating head according to the present invention;
- Figure 2 shows a longitudinal section of a reduction set for the rotating head according to the present invention;
- Figure 3 shows a partial section of a crankshaft and the reduction set mounted on it总觉得;

[0010] In accordance with the present invention, in Figure the reference number 1 indicates a support structure and the reference numbers 2, 3 indicate two motor groups of the rotating head.

[0011] The support structure 1 is substantially conventional. It presents a base bearing 5 for the rotation of a sleeve 8 of the rotating head by means of a crown gear 6, mounted pivotingly on the base bearing 4.

[0012] Each of the motor groups 2, 3, which can be more than two, but at the limit even just one, includes coaxially in cascade a hydraulic motor 7, for instance with variable displacement, a reduction set 8, a pinion 9 engaged with the crown gear 6. Even just one of the motor groups, the group 2 in the drawing, also bears, joined coaxially to the side opposite the variable displacement hydraulic motor 7, a hydraulic motor 10, for instance with constant displacement, and a reduction gear 11 connected to the pinion 9 to the side opposite the reduction set 8.

[0013] With reference to Figure 2, each reduction set 8 comprises at least a first epicyclic reduction gear 12, driven by the variable displacement hydraulic motor 7 and connected to a second epicyclic reduction gear 13, through a coaxial coupling shaft 14 wherein a multiple disk clutch coupling 15 is mounted.

[0014] With particular reference to the embodiment of the reduction set shown in Figure 2, the first epicyclic or sun-and-planet reduction gear 12 is contained inside a box formed by an upper closure flange 16, which bears on a ball bearing 17, an input shaft 18 keyed onto the
output shaft (not shown) of the hydraulic motor 7, and by a support 19 for a straight toothed gear crown 20 of the first reduction gear 12. With the crown 20 are internally engaged satellites 21, such as spur gears, borne on a related train holder 22 and engaged with a sun gear or sprocket 23 keyed onto the input shaft 18.

[0015] The shaft driven by the first epicyclic reduction gear 12 is the coaxial shaft 14 for coupling with the second epicyclic reduction gear 13. Coaxially to the shaft 14 is the clutch coupling 15. Externally, it comprises a closure flange 24 integral to the support 19 of the crown 20 of the first reduction gear 12 by means of screws 25, a central body 26, joined superiorly with bolts 27 to the closure flange 24 and inferiorly to a frame 28 of the second epicyclic reduction gear 13.

[0016] Internally from top to bottom, coaxially to the shaft 14 a pair of Belleville washers 29 is provided, set against the closure flange 24 of the clutch coupling 15, situated on a support 30 for the Belleville washers 29, a ring 31 for guiding the support 30, driving and driven disks 32, 33 between upper and lower clutch contrast rings 34, 35, on a clutch disk holder 36. The disk holder 36 is engaged by means of grooved profiles with a driving flange 37 engaged with a straight tooth crown gear 38 of the second epicyclic reduction gear 13. On the same crown 38 are internally engaged satellites 39, such as spur gears, borne on related train holder 40 and engaged with a sun gear or sprocket 41 keyed onto the coupling shaft 14 between first and second reduction gear. The train holder 40 is integral with a grooved sleeve 42, pivoting mounted, by means of a ball bearing 43, on a lower flange 44 of the second epicyclic reduction gear 13.

[0017] A chamber 45 delimited by the support 30, by the guide ring 31 and by the closure flange 24 is hermetically sealed and constitutes part of a hydraulic circuit with which it communicates through an orifice 46.

[0018] On the grooved sleeve 41 is mounted the pinion 9 (Figure 1) which, as stated above, is engaged with the reduction gear 11, on the side opposite the second epicyclic reduction gear 13.

[0019] The operation of the rotating head according to the present invention is as follows.

[0020] With reference to Figure 1, the motor moment to the crown gear 6 is transmitted by the motor groups 2, 3, in particular by the variable displacement hydraulic motors 7 by means of the coupling of its output shaft with the input shaft 18 of the reduction set 8 (Figure 2). The input shaft 18 belongs to the first epicyclic reduction gear 12 and, thanks to the connection with the satellite gear holder 22, achieves the first reduction ratio by reaction with the fixed crown gear 20.

[0021] At the output of the first epicyclic reduction gear 12, the motor moment is transmitted to the central shaft 14 which, in turn, transmits it to the second epicyclic reduction gear 13 by means of the reaction with the crown gear 38 which is held motionless by means of the clutch coupling 15, in particular thanks to the pressure of the Belleville washers which press on the pack of driving and driven disks 32, 33. At the output of the second epicyclic reduction gear 13 the motor moment is transmitted to the pinion 9, and thence to the crown gear 6 and to the base bearing 4, and as a consequence to the sleeve 5 of the rotating head.

[0022] It should be stressed that the multiple driving and driven disks 32, 33 of the clutch coupling 15 are associated, for the driving approach, to the pair of Belleville washers 29 set between the closure flange 24 and the Belleville washer support 30, opposite to the related guide ring 31 through the oil tight chamber 45. The chamber 45 is part of a hydraulic command circuit for the relative approach of the Belleville washers 29 and the consequent relative separation of the multiple disks 32, 33 for the uncoupling of the clutch coupling 15 and the interruption of the transmission of the motor moment in the reduction set 8. This is obtained by supplying pressurised oil into the chamber 45 through the orifice 46, oil which compresses the Belleville washers 29, and the pack of driving and driven disks 32, 33 remaining free, makes the crown gear 38 idle and disconnects the second epicyclic reduction gear 13, interrupting the transmission of the motor moment from the hydraulic motors 7 to the pinion 9.

[0023] This occurs in the case of fast discharging, when the motor moment to be transmitted to the sleeve 5 is not transmitted by the variable displacement motor 7, but by the constant displacement motor 10.

[0024] The invention thus conceived can be subject to numerous modifications and variations, without thereby departing from the scope of the inventive concept according to the claims. It should further be kept in mind that the hydraulically commanded clutch coupling according to the invention can be applied also to other devices than a rotating head, which represents the currently preferred application, devices wherein a connection between two coaxial shafts needs to be obtained in order to be able to transmit a given torque moment, whilst retaining the possibility of interrupting the connection and reconstructing it at will. Moreover, all components can be replaced with technically equivalent elements.

Claims

1. Rotating head of a drilling column with friction coupling, characterised in that it comprises a support structure (1) circumferentially bearing at least a motor set (2, 3) for rotating a sleeve (5) of the rotating head through a crown gear (6), rotatably mounted on a base bearing (4); said at least one motor set (2, 3) including coaxially in cascade a first hydraulic motor, a reduction set (8) with hydraulically commanded clutch coupling (15), a pinion (9), connected to said reduction set (8) and engaged with said crown gear (6) of the support structure (1); wherein at least a single motor set (2) also carries joined co-
axially to the side opposite to said first hydraulic motor (7), a second hydraulic motor (10) and a reduction gear (11) connected to said pinion (9) at the opposite side of said reduction set (8).

2. Rotating head according to claim 1, characterised in that said reduction set (8) comprises at least a first epicyclic reduction gear (12), driven by said first motor (7) and connected to a second epicyclic reduction gear (13), by means of a coaxial coupling shaft (14) whereon a multiple-disk clutch coupling (15) is mounted.

3. Rotating head according to claim 2, characterised in that said multiple disks (32, 33) of the clutch coupling (15) are associated, for the driving approach, to at least a pair of Belleville washers (29) set between a closure flange (24) and a Belleville washer support (30), opposite to a related guide ring (31) through an oil tight chamber (45): said chamber (45) being part of a hydraulic command circuit for the relative approach of said Belleville washers (29) and the consequent relative separation of said multiple disks (32, 33), for the uncoupling of the clutch coupling (15) and the interruption of the transmission of the motor moment in said reduction set (8).

4. Rotating head according to claim 1, characterised in that said first hydraulic motor has variable displacement.

5. Rotating head according to claim 1, characterised in that said second hydraulic motor has constant displacement.

Patentansprüche

1. Drehbohrkopf einer Bohrsäule mit Reibkupplung, dadurch gekennzeichnet, dass er eine Trägerstruktur (1) enthält, die umlaufend wenigstens eine Antriebsgruppe (2, 3) zum Drehen eines Bohrkopfes (5) trägt, drehbar montiert auf einem Spurlager (4); wobei die wenigstens eine genannte Antriebsgruppe (2, 3) koaxial und kaskadenartig einen ersten Hydraulikmotoren, eine Reduziervorrichtung (8) mit hydraulisch betätigter Kupplung (15), ein Ritzel (9), angeschlossen an die genannte Reduziervorrichtung (8) und mit dem genannten Zahnkranz (6) der Trägerstruktur (1) im Eingriff stehend, enthält; wobei wenigstens eine einzige Antriebsgruppe (2), angeschlossen koaxial an die Seite entgegengesetzt von dem genannten ersten Hydraulikmotor (7), auch einen zweiten Hydraulikmotor (10) und ein Untersetzungsgetriebe (11) trägt, angeschlossen an das genannte Ritzel (9) auf der entgegengesetzten Seite von der genannten Reduziervorrichtung (8).

2. Drehbohrkopf nach Patentanspruch 1, dadurch gekennzeichnet, dass die genannte Reduziervorrichtung (8) wenigstens ein erstes Umlaufgetriebe (12) enthält, angetrieben durch den genannten ersten Motor (7) und angeschlossen an ein zweites Umlaufgetriebe (13) mit Hilfe einer koaxialen Kupplungswelle (14), an welcher eine Mehrscheibenkupplung (15) montiert ist.

3. Drehbohrkopf nach Patentanspruch 2, dadurch gekennzeichnet, dass die genannten mehrfachen Scheiben (32, 33) der Kupplung (15) zur Antriebsnäherung wenigstens einem Paar von Tellerfedern (29) zugeordnet sind, angeordnet zwischen einem Abschlussflansch (24) und einem Tellerfederhalter (30) und gegenüberliegend einem entsprechenden Führungsring (31) durch eine abdichtende Kammer (45); wobei die genannte Kammer (45) Teil eines hydraulischen Antriebskreises für die entsprechende Annäherung der genannten Tellerfedern (29) und das folgende entsprechende Trennen der genannten mehrfachen Scheiben (32, 33) ist, also zum Auskuppeln der Kupplung (15) und zum Unterversagen der Übertragung des Antriebsmomentes in die genannte Reduziervorrichtung (8).

4. Drehbohrkopf nach Patentanspruch 1, dadurch gekennzeichnet, dass der genannte erste Hydraulikmotor einen veränderbaren Hubraum hat.

5. Drehbohrkopf nach Patentanspruch 1, dadurch gekennzeichnet, dass der genannte zweite Hydraulikmotor einen konstanten Hubraum hat.

Revendications

1. Tête rotative de forage avec connecteur-embrayage, caractérisé en ce qu'elle comporte une structure support (1) portant sur sa circonférence au moins un ensemble moteur (2, 3) pour la rotation d'un manchon (5) de la tête rotative à travers une couronne dentée (6), montée à rotation sur un coussinet de base (4); ledit au moins un ensemble moteur (2, 3) comprenant de manière coaxiale en cascade un premier moteur hydraulique, un ensemble de réduction (8) avec un embrayage (15) à commande hydraulique, un pignon (9) relié audit ensemble de réduction (8) et engagé à ladite couronne dentée (6) de la structure support (1), dans laquelle au moins un ensemble moteur individuel (2) porte également, uni de manière coaxiale sur le côté opposé audit premier moteur hydraulique (7), un deuxième moteur hydraulique (10) et un réducteur à engrenages (11) relié audit pignon (9) en correspondance avec le côté opposé dudit ensemble de
réduction (8).

2. **Tête rotative selon la revendication 1, caractérisée en ce que** ledit ensemble de réduction (8) comporte au moins un premier réducteur à engrenages épi-cycloïdal (13), entraîné par ledit premier moteur (7) et relié à un deuxième réducteur à engrenages épi-cycloïdal par l'intermédiaire d'un arbre coaxial d'ac-couplement (14) sur lequel est monté un embrayage (15) à disques multiples.

3. **Tête rotative selon la revendication 2, caractérisée en ce que** lesdits disques multiples (32, 33) de l'embrayage (15) sont associés, pour le rapprochement d'entraînement, à au moins une paire de rondelles cuvettes (29) disposées entre une collierette de fermeture (24) et un support de rondelles cuvettes (30), en regard d'un anneau de guidage respectif (31) à travers une chambre étanche à l'huile (45): ladite chambre (45) faisant partie d'un circuit de commande hydraulique pour le rapprochement relatif desdits ressorts cuvettes (29) et l'éloignement relatif qui suit desdits disques multiples (32, 33), pour le débrayage de l'embrayage (15) et l'interruption de la transmission du moment moteur dans ledit ensemble de réduction (8).

4. **Tête rotative selon la revendication 1, caractérisée en ce que** ledit moteur hydraulique a une cylindrée variable.

5. **Tête rotative selon la revendication 1, caractérisée en ce que** ledit deuxième moteur hydraulique a une cylindrée constante.