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(54) **Reel-up device and a method of reeling a fiber web**

Aufrollmachine und Verfahren zum Rollen einer Faserbahn

Enrouleuse et méthode d'enroulement d'une bande fibreuse

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Description

[0001] The invention relates to a reel-up for continuous reeling of a fiber web into a parent roll around a reeling shaft. Especially the invention relates to a reel-up according to the preamble of claim 1 and to a method of reeling a fiber web according to the preamble of claim 10.

[0002] The invention also relates to a method of continuous reeling of the fiber web around the reeling shaft.

[0003] A reel-up is a device that reels a material, which is produced as a continuous fiber web in a fiber web production line, into the form of a roll, a parent (machine, jumbo) roll. In the production process of the fiber web, the reeling is generally a first process part, wherein a continuous process is discontinued to be continued in sequences. The parent roll is formed around the reeling shaft that functions as core of reeling, i.e. the fiber web on one parent roll has a beginning and an end. A trend in the field is the continuous increase in parent rolls, causing need for the development of reel-ups.

[0004] A prior art method described in the FI-patent 91383 (EP 0483092 B1) changed the size of parent rolls into a new order, since it was possible to build the first part of the parent roll without affecting the properties of the fiber web that was to be reeled. The importance of the beginning of reeling becomes emphasized, when the amount of fiber web to be reeled is increased, since the beginning of the parent roll functions as the base of the roll structure. One feature that improved the technology was the progressive center torque of the parent roll that was provided by means of primary and secondary drives, enabling the versatile use of reeling parameters in building the parent roll. Prior art also discloses an example in which primary and secondary drive are engaged by a drive unit, with which the reeling shaft of the parent roll to be reeled is engaged during reeling with help of a cylinder arrangement located in connection with transmission. This arrangement has been described in US patent 5069394 and the drive arrangement is engageable and detachable by means of a cylinder device. In this kind of reel-ups the primary center drive and the primary carriage as well as the secondary center drive and the secondary reeling carriage move simultaneously, since the center drive is mechanically constructed in connection with the carriage and they are moved by same actuator.

[0005] A prior art method described in the US-patent 5370327 introduced idea that a parent roll would be built on one vertical plane, so that the parent roll would be on horizontal rails and at the same vertical height throughout the reeling. FI-patent 91383 also presented this type of solution, but before beginning to reel, the reeling shaft was moved along curved path into its initial reeling position. In the reel-up according to the US-patent 5370327 a moving reeling cylinder makes it possible to keep the center of the reeling shaft on a constant level. One advantage of this solution is changing the adjustment of the nip power from loading on the side of the parent roll to loading on the side of a constant mass reeling cylinder.

[0006] In US patent publication 5673870 is disclosed a reel apparatus for reeling a traveling web produced on a papermaking machine, which comprises a rotatable support drum, which is fixedly mounted in a frame and a pair of parallel, horizontally disposed rails mounted to the frame with the tops of the rails above the apex of the support drum. New reel spools are brought into supporting engagement on the rails at a location downstream of the apex of the support drum and intermediate the apex of the support drum and a jumbo-sized wound web roll which is being wound while being powered by a center wind assist drive, as well as nipping engagement with the support drum. Each reel spool is supported in a pair of carriages which are mounted to travel over the rails. In the reel apparatus two sets of a complimentary pair of carriages can be disposed about a single pair of rails to handle two different reel spools simultaneously as one reel spool beings the web reeling process and the other reel spool is finished being wound.

[0007] In WO publication 2009080890 is disclosed a reel-up for continuous reeling of fiber web into a parent roll around a reeling shaft, in which the reeling cylinder with its axis in the cross direction is shorter than the nominal bearing distance of the reeling cylinder and that the reeling cylinder is movable in vertical direction in the free clearance of the frames of the reel-up.

[0008] In WO publication 2010000915 is disclosed a reel-up for continuous reeling of fiber web around a reeling shaft to form a parent roll, the reel-up comprising a reeling cylinder, whereby a nip load can be formed between the parent roll and the reeling drum cylinder, the parent roll being arranged so as to be movable during the reeling along an substantially horizontal path from the starting point of the reeling to the point of transfer of the completed parent roll, the starting point of the reeling being upstream of the reeling cylinder and the point of transfer downstream of the same. Upstream of the reeling cylinder, there are primary support means for supporting the parent roll against the reeling cylinder and downstream of the reeling drum, there are secondary forks for supporting the machine roll against the reeling drum.

[0009] In prior art reel-ups for example of those kinds of reel-ups that are disclosed in the two above mentioned WO-publications one possibility of moving the reeling shaft and the parent roll is to construct two carriage pairs, one carriage for each end of the reeling shaft / the parent roll for the movement. It is also known from prior art to construct for movements of the reeling shaft and the parent roll a combination of a carriage pair and a fork pair. In this description and claims the movement device is mainly referred as a carriage but it should be noted that a carriage pair can be replaced by a fork pair as well. In order to transfer the parent roll from one carriage to the other the paths of the carriages must be able to cross. One possibility would be to construct one carriage pair outside the guides of the reel-up and another carriage pair inside the guides of the reel-up but in reel-ups with

center drives the drives must be located outside the guides, which creates the problem of synchronizing the position between the center drive and the carriage pair moving inside the guides of the reel-up. Synchronizing is necessary especially in change of the drive when the secondary drive is engaged to the parent roll in reeling speed.

[0010] An object of the invention is to develop a solution that would enable the buildup of even larger parent rolls than before.

[0011] One further object of the invention is to further develop reel-ups of the kinds of reel-ups that are disclosed in the two above mentioned WO-publications, especially in relation the possibility of moving the reeling shaft and the parent roll is by two carriage pairs / by a carriage and a fork pair for the movement.

[0012] One further object of the invention is also to achieve a solution for synchronizing the position between the center drive and the carriage pair of the reel-up.

[0013] The reel-up according to the invention is mainly characterized by the features of the characterizing part of claim 1.

[0014] The method according to the invention, in turn, is characterized by the features of the characterizing part of claim 10.

[0015] According to an advantageous view point of the invention a reel-up which comprises two pairs of carriages (or a pair of carriages and a pair of forks) for moving the reeling shaft and the parent roll to be reeled and in which one carriage pair, primary carriage pair, is located outside the guides of the reel-up and another carriage pair, secondary carriage pair, is located inside the guides and in which primary and secondary center drives for rotating the reeling shaft (and thus the parent roll) are located outside the guides. The reel-up is for moving the secondary center drive located outside the guides and the secondary carriage pair located inside the guides provided by at least two actuators, for example by screws or by hydraulic cylinders. In the reel-up at least one of the secondary carriages located inside the guides and the secondary center drive located outside the guides are synchronized electrically, advantageously synchronized by servo technical means for example by servo motor control system. Synchronizing by servo technical means provides accurate and reproducible synchronizing of the movements of the actuators due to good controllability of servo motors. According to advantageous feature the position measurement can be constructed as separate means or the position measurement can be integrated in the servo motor.

[0016] According to an advantageous feature of the invention the carriage pair located outside the guides and the center drive located outside the guides are mechanically connected to each other.

[0017] According to one view point of the invention in a reel-up where the carriage pair located inside the guides is replaced by secondary forks the synchronizing of the actuator and the forks can be replaced by using location measurement device for measuring the location and by defining geometry of the actuator and calculating with this information the position of the reeling shaft in drive change accurately.

[0018] In a reel-up according to the invention frame structure can be constructed to be simple and for example then use of concrete foundation is possible, because of rigid structure of the reel-up, which also provides for cost savings.

[0019] For further development of reel-ups of the types disclosed in the two above mentioned WO-publications the electronic synchronizing, especially synchronizing by servo technical means, is very advantageous since this provides for the possibility of moving the carriages and the center drives in linear movements and no circular movements are needed, because according to the advantageous feature arranged position measurement is integrated with the servo motors and less automation software is needed and of faster and accurate synchronization is accomplished especially in connection with the movement of the secondary carriages located inside the guides, which in turn provides for cost savings and simple construction.

[0020] Electrical synchronizing of the movements of at least one of the secondary carriages and the secondary drive according to the invention also provides for the possibility of modular construction of a reel-up, because of rigid frames and thus good support for heavy masses is accomplished since due to the inventive arrangement the frame structures need not to be cut for the movements of carriages.

[0021] In the following the invention is further explained in detail with reference to the accompanying drawing in which

[0022] In figure 1 is schematically presented one advantageous example of a reel-up according to the invention.

[0023] In the schematic example of figure 1 the reel-up 10 comprises guides 11, 12 on which reeling shafts 15 are supported at each end. The reel-up 10 further comprises a reeling cylinder 25 that forms a reeling nip with the parent roll 20 to be reeled around its reeling shaft 15. For moving the reeling shafts 15 and the parent roll 20 carriages 23, 26A, 26B are supported on the guides 11, 12. Primary carriage pair 23 is located outside the guides 11, 12 and secondary carriage pair 26A, 26B is located inside the guides 11, 12. Primary center drive 24 for rotating the reeling shaft 15 when the reeling shaft 15 is in the primary carriages 23 is located outside the guides 11, 12. The primary carriages 23 and the primary center drive 24 are mechanically connected to each other, since they are located outside the guides 11, 12. Secondary drive 29 for rotating the reeling shafts 15 when the reeling shaft is in the secondary carriages 26A, 26B are located outside the guides 11, 12 and at least one of the secondary carriages 26A, 26B, advantageously the secondary carriage 26A located at the side of the secondary center drive 29, and the secondary center drive 29 are synchro-

nized electrically and they are moved by their own actuators, since they are located on different sides of the guides 11, 12. The carriages 26A, 26B are synchronized with each other and in some special cases they can have some controlled position difference. The electrical synchronizing is provided by synchronizing the clutch of the secondary center drive 29 and the clutch housing of the reeling shaft 15 when the reeling shaft 15 is in the secondary carriage 26A, 26B.

[0024] The reel-up 10 comprises two pairs of carriages 23, 26A, 26B, one pair 23, primary carriage 23, for moving the reeling shaft 15 and the parent roll 20 to be reeled in the beginning stages of reeling and one pair 26A, 26B, secondary carriage for moving the reeling shaft and the parent roll 20 to be reeled after the beginning stages of reeling and to finishing stages of reeling. In the reel-up 10 each carriage pair 23, 26A, 26B has a carriage engaged to each end of a reeling shaft 15.

[0025] In the figure 1 secondary carriage pair 26A, 26B is connected to the reeling shaft 15 around which the parent roll 20 is reeled. The primary carriage pair 23 is connected to the reeling shaft 15 around which the next parent roll will be reeled when moved to the reeling position to form the reeling nip with the reeling cylinder 25 located inside frames 27 of the guides 11, 12.

[0026] Frames 27, 28 of the reel-up are shown in the figure 1 only schematically.

[0027] For moving the secondary carriage 26A, 26B pair and the secondary center drive 29 located outside the guide 11, 12 are provided at least two actuators, for example screws or hydraulic cylinders, which are synchronized electrically, advantageously synchronized by servo technical means, for example by servo motor control system. In movement I the carriages 23 and the center drive 24 are mechanically connected and in movement II the carriages 26A, 26B are thus synchronized electrically or by corresponding manner such that no mechanical synchronization is needed there between. The carriage 26A, which is at the same side as the center drive 29 are synchronized as the carriage 26A moves the reeling shaft 15 onto which the center drive 29 is connected. Carriage 26B can be even in slight off-synchronized for example in cases where the parent roll 20 is carrot-like i.e. the diameter of the parent roll 20 is larger / smaller at the side of the carriage 26B than at the other side.

Claims

1. A reel-up which comprises two pairs of carriages (23, 26A, 26B) for moving a reeling shaft (15) and a parent roll (20) to be reeled around a reeling shaft (15) supporting the reeling shaft (15) at its each end and center drives (24, 29) for rotating the reeling shaft (15), **characterized in, that** in the reel-up (10) one carriage (26A, 26B) pair is located inside the guides (11, 12) and provides for the secondary carriages (26A, 26B),
that in the reel-up (10) at least a secondary center drive (29) is located outside the guides (11, 12),
that at least for moving the secondary drive (29) and the secondary carriages (26A, 26B) the reel-up (10) comprises at least two actuators and that at least the secondary drive (29) and at least one of the secondary carriages (26A, 26B) are synchronized electrically.

2. A reel-up according to claim 1, **characterized in, that** in the reel-up (10) the other carriage (23) pair is located outside the guides (11, 12) provides for the primary carriages (23) and a primary center drive (24) is located outside the guides (11, 12).

3. A reel-up according to claim 2, **characterized in, that** in the reel-up (10) primary carriage (23) pair located outside the guides (11, 12 and the primary center drive (24) are located outside the guides (11, 12) are connected mechanically.

4. A reel-up according to claim 1, **characterized in, that** the at least the secondary drive (29) and at least one of the secondary carriages (26A, 26B) are synchronized by servo technical means.

5. A reel-up according to any of claim 1 or 2, **characterized in, that** the at least the secondary drive (29) and at least one of the secondary carriages (26A, 26B) are synchronized by servo motor control system.

6. A reel-up according to any of claims 1 - 5, **characterized in, that** the at least two actuators of the reel-up (10) comprise screws.

7. A reel-up according to any of claims 1 - 6, **characterized in, that** the at least two actuators of the reel-up (10) comprise hydraulic cylinders.

8. A reel-up according to claim 1, **characterized in, that** in the reel-up (10) the secondary carriage pair located inside the guides (11, 12) is provided as a pair of secondary forks and that the synchronizing of the secondary center drive (29) and the forks is provided by location measurement device for measuring the location and by defining geometry of the movement of the forks and by calculating means to the position of the reeling shaft (15) in center drive change.

9. A reel-up according to claim 1, **characterized in, that** the electrical synchronizing is provided by synchronizing a clutch of the secondary center drive (29) and a clutch housing of the reeling shaft (15).

10. A method of reeling a fiber web in a reel-up (10) comprising two pairs of carriages (23, 26A, 26B) for

moving a reeling shaft (15) and a parent roll (20) to be reeled around a reeling shaft (15) supporting the reeling shaft (15) at its each end and center drives (24, 29) for rotating the reeling shaft (15), **characterized in, that** in the reel-up (10) one carriage (26A, 26B) pair is located inside the guides (11, 12) and provides for the secondary carriages (26A, 26B), and at least a secondary center drive (29) is located outside the guides (11, 12), and that in the method the secondary center drive (29) located outside the guides (11, 12) and the secondary carriages (26A, 26B) are moved by at least two actuators and the secondary center drive and at least one of the secondary carriages (26A, 26B) are synchronized electrically.

11. A method according to claim 10, **characterized in, that** in the reel-up (10) the secondary carriage pair located inside the guides (11, 12) is provided as secondary forks and that the synchronizing of the secondary drive and the forks is provided by location measurement device for measuring the location and by defining geometry of the movement of the forks and by calculating means to the position of the reeling shaft in drive change.

Patentansprüche

1. Aufwickler, der zwei Paare von Laufwagen (23, 26A, 26B) zum Bewegen einer Wickelwelle (15) und einer um die Wickelwelle (15) aufzuwickelnde Mutterrolle bzw. Volltambour (20), welche die Wickelwelle (15) an ihren jeweiligen Enden stützt, und Zentral antriebe (24, 29) zum Rotieren der Wickelwelle (15) aufweist,
dadurch gekennzeichnet, dass
in dem Aufwickler (10) ein Paar von Laufwagen (26A, 26B) innerhalb der Führungen (11, 12) angeordnet ist und die sekundären Laufwagen (26A, 26B) bildet, dass bei dem Aufwickler (10) wenigstens ein sekundärer Zentralantrieb (29) außerhalb der Führungen (11, 12) angeordnet ist, dass zumindest zum Bewegen des sekundären Antriebs (29) und der sekundären Laufwagen (26A, 26B) der Aufwickler (10) zumindest zwei Aktuatoren aufweist, und
dass zumindest der sekundäre Antrieb (29) und zumindest einer der sekundären Laufwagen (26A, 26B) elektrisch synchronisiert sind.

2. Aufwickler nach Anspruch 1,
dadurch gekennzeichnet , dass
in dem Aufwickler (10) das andere Paar von Laufwagen (23) außerhalb der Führungen (11, 12) angeordnet ist und die primären Laufwagen (23) bildet, und ein primärer Zentralantrieb (24) außerhalb der Führungen (11, 12) angeordnet ist.

3. Aufwickler nach Anspruch 2,
dadurch gekennzeichnet, dass
in dem Aufwickler (10) das Paar primärer Laufwagen (23), das außerhalb der Führungen (11, 12) angeordnet ist, und der primäre Zentralantrieb (24), der außerhalb der Führungen (11, 12) angeordnet ist, mechanisch miteinander verbunden sind.

4. Aufwickler nach Anspruch 1,
dadurch gekennzeichnet, dass
der wenigstens eine sekundäre Antrieb (29) und wenigstens einer der sekundären Laufwagen (26A, 26B) mittels servertechnischer Einrichtungen synchronisiert sind.

5. Aufwickler nach Anspruch 1 oder 2,
dadurch gekennzeichnet , dass
der wenigstens eine sekundäre Antrieb (29) und wenigstens einer der sekundären Laufwagen (26A, 26B) mittels eines Servomotorsteuersystems synchronisiert sind.

6. Aufwickler nach einem der Ansprüche 1 - 5,
dadurch gekennzeichnet , dass
die wenigstens zwei Aktuatoren des Aufwicklers (10) Schrauben aufweisen.

7. Aufwickler nach einem der Ansprüche 1 - 6,
dadurch gekennzeichnet , dass
die wenigstens zwei Aktuatoren des Aufwicklers (10) Hydraulikzylinder aufweisen.

8. Aufwickler nach Anspruch 1,
dadurch gekennzeichnet , dass
in dem Aufwickler (10) das Paar sekundärer Laufwagen, das innerhalb der Führungen (11, 12) angeordnet ist, als ein Paar sekundärer Gabeln ausgebildet ist, und dass die Synchronisierung des sekundären Zentralantriebs (29) und der Gabeln durch eine Positionsmesseinrichtung zum Messen der Position und durch Definieren der Geometrie der Bewegung der Gabeln und durch eine Berechnungseinrichtung der Position der Wickelwelle (15) bei einem Wechsel des Zentralantriebs gebildet ist.

9. Aufwickler nach Anspruch 1,
dadurch gekennzeichnet, dass
die elektrische Synchronisierung durch Synchronisieren einer Kupplung des sekundären Zentralantriebs (29) und eines Kupplungsgehäuses der Wickelwelle (15) gebildet ist.

10. Verfahren zum Aufwickeln einer Faserbahn in einen Aufwickler (10), der zwei Paare von Laufwagen (23, 26A, 26B) zum Bewegen einer Wickelwelle (15) und einer um die Wickelwelle (15) aufzuwickelnde Mutterrolle bzw. Volltambour (20), welche die Wickelwelle (15) an ihren jeweiligen Enden stützt, und Zen-

tralantriebe (24, 29) zum Rotieren der Wickelwelle (15) aufweist,
dadurch gekennzeichnet, dass
in dem Aufwickler (10) ein Paar von Laufwagen (26A, 26B) innerhalb der Führungen (11, 12) angeordnet ist und die sekundären Laufwagen (26A, 26B) bildet und wenigstens ein sekundärer zentraler Antrieb (29) außerhalb der Führungen (11, 12) angeordnet ist, und dass bei dem Verfahren der sekundäre Zentralantrieb (29), der außerhalb der Führungen (11, 12) angeordnet ist, und die sekundären Laufwagen (26A, 26B) mittels wenigstens zweier Aktuatoren bewegt werden und der sekundäre Zentralantrieb und wenigstens einer der sekundären Laufwagen (26A, 26B) elektrisch synchronisiert sind.

11. Verfahren nach Anspruch 10,
dadurch gekennzeichnet, dass
in dem Aufwickler (10) das Paar sekundärer Laufwagen, das innerhalb der Führungen (11, 12) angeordnet ist, als sekundäre Gabeln ausgebildet ist, und dass die Synchronisierung des sekundären Zentralantriebs und der Gabeln durch eine Positionsmesseinrichtung zum Messen der Position und durch Definieren der Geometrie der Bewegung der Gabeln und durch eine Berechnungseinrichtung der Position der Wickelwelle bei einem Wechsel des Zentralantriebs gebildet wird.

Revendications

1. Dispositif d'enroulement comprenant deux paires de chariots (23, 26A, 26B) pour faire se mouvoir un arbre d'enroulement (15) et une bobine mère (20) devant être enroulée autour d'un arbre d'enroulement (15) en supportant l'arbre d'enroulement (15) à chacune de ses extrémités et des entraînements centraux (24, 29) pour faire tourner l'arbre d'enroulement (15), **caractérisé en ce que**, dans le dispositif d'enroulement (10), une paire de chariots (26A, 26B) est située à l'intérieur des guides (11, 12) et fait office de chariots secondaires (26A, 26B),
en ce que, dans le dispositif d'enroulement (10), au moins un entraînement central (29) secondaire est situé en dehors des guides (11, 12),
en ce que, au moins pour faire se mouvoir l'entraînement secondaire (29) et les chariots secondaires (26A, 26B), le dispositif d'enroulement (10) comprend au moins deux actionneurs, et **en ce que** au moins l'entraînement secondaire (29) et au moins l'un des chariots secondaires (26A, 26B) sont synchronisés électriquement.

2. Dispositif d'enroulement selon la revendication 1, **caractérisé en ce que**, dans le dispositif d'enroulement (10), l'autre paire de chariots (23) qui se situe en dehors des guides (11, 12) fait office de chariots primaires (23) et un entraînement central primaire (24) se situant en dehors des guides (11, 12).

3. Dispositif d'enroulement selon la revendication 2, **caractérisé en ce que**, dans le dispositif d'enroulement (10), la paire de chariots primaires (23) située en dehors des guides (11, 12) et l'entraînement central primaire (24) se situant en dehors des guides (11, 12) sont connectés mécaniquement.

4. Dispositif d'enroulement selon la revendication 1, **caractérisé en ce que**, au moins l'entraînement secondaire (29) et au moins l'un d'entre les chariots secondaires (26A, 26B) sont synchronisés par des moyens techniques d'asservissement.

5. Dispositif d'enroulement selon l'une quelconque des revendications 1 ou 2, **caractérisé en ce que**, au moins l'entraînement secondaire (29) et au moins l'un d'entre les chariots secondaires (26A, 26B) sont synchronisés grâce à un système de contrôle par servomoteur.

6. Dispositif d'enroulement selon l'une quelconque des revendications 1-5, caractérisé que les au moins deux actionneurs du dispositif d'enroulement (10) comprennent des vis.

7. Dispositif d'enroulement selon l'une quelconque des revendications 1-6, **caractérisé en ce que** les au moins deux actionneurs du dispositif d'enroulement (10) comprennent des cylindres hydrauliques.

8. Dispositif d'enroulement selon la revendication 1, **caractérisé en ce que**, dans le dispositif d'enroulement (10), la paire de chariots secondaires située à l'intérieur des guides (11, 12) est fournie en tant qu'une paire de fourches secondaires et **en ce que** la synchronisation de l'entraînement central secondaire (29) et des fourches est assurée grâce à un dispositif de mesure d'emplacement pour mesurer l'emplacement et en définissant la géométrie du mouvement des fourches et grâce à un moyen de calcul de la position de l'arbre d'enroulement (15) dans un changement de l'entraînement central.

9. Dispositif d'enroulement selon la revendication 1, **caractérisé en ce que** la synchronisation électrique est assurée en synchronisant un embrayage de l'entraînement central secondaire (29) et un carter d'embrayage de l'arbre d'enroulement (15).

10. Procédé pour enrouler une nappe de fibres dans un dispositif d'enroulement (10) comprenant deux paires de chariots (23, 26A, 26B) pour faire se mouvoir un arbre d'enroulement (15) et une bobine mère (20) à enrouler autour d'un arbre d'enroulement (15) en supportant l'arbre d'enroulement (15) à chacune de

ses extrémités et des entraînements centraux (24, 29) pour faire tourner l'arbre d'enroulement (15), **caractérisé en ce que**, dans le dispositif d'enroulement (10), une paire de chariots (26A, 26B) se situe à l'intérieur des guides (11, 12) et fait office de chariots secondaires (26A, 26B) et au moins un entraînement central secondaire (29) se situant en dehors des guides (11, 12) et **en ce que**, dans le procédé, l'entraînement central secondaire (29) situé en dehors des guides (11, 12) et les chariots secondaires (26A, 26B) sont mis en mouvement grâce à au moins deux actionneurs et l'entraînement central secondaire et au moins l'un d'entre les chariots secondaires (26A, 26B) étant synchronisés électriquement.

11. Procédé selon la revendication 10, **caractérisé en ce que**, dans le dispositif d'enroulement (10), la paire de chariots secondaires située à l'intérieur des guides (11, 12) est fournie en tant que fourches secondaires et **en ce que** la synchronisation de l'entraînement secondaire et des fourches est assurée grâce à un dispositif de mesure d'emplacement pour mesurer un emplacement et en définissant la géométrie du mouvement des fourches et grâce à un moyen de calcul pour la position de l'arbre d'enroulement dans un changement d'entraînement.

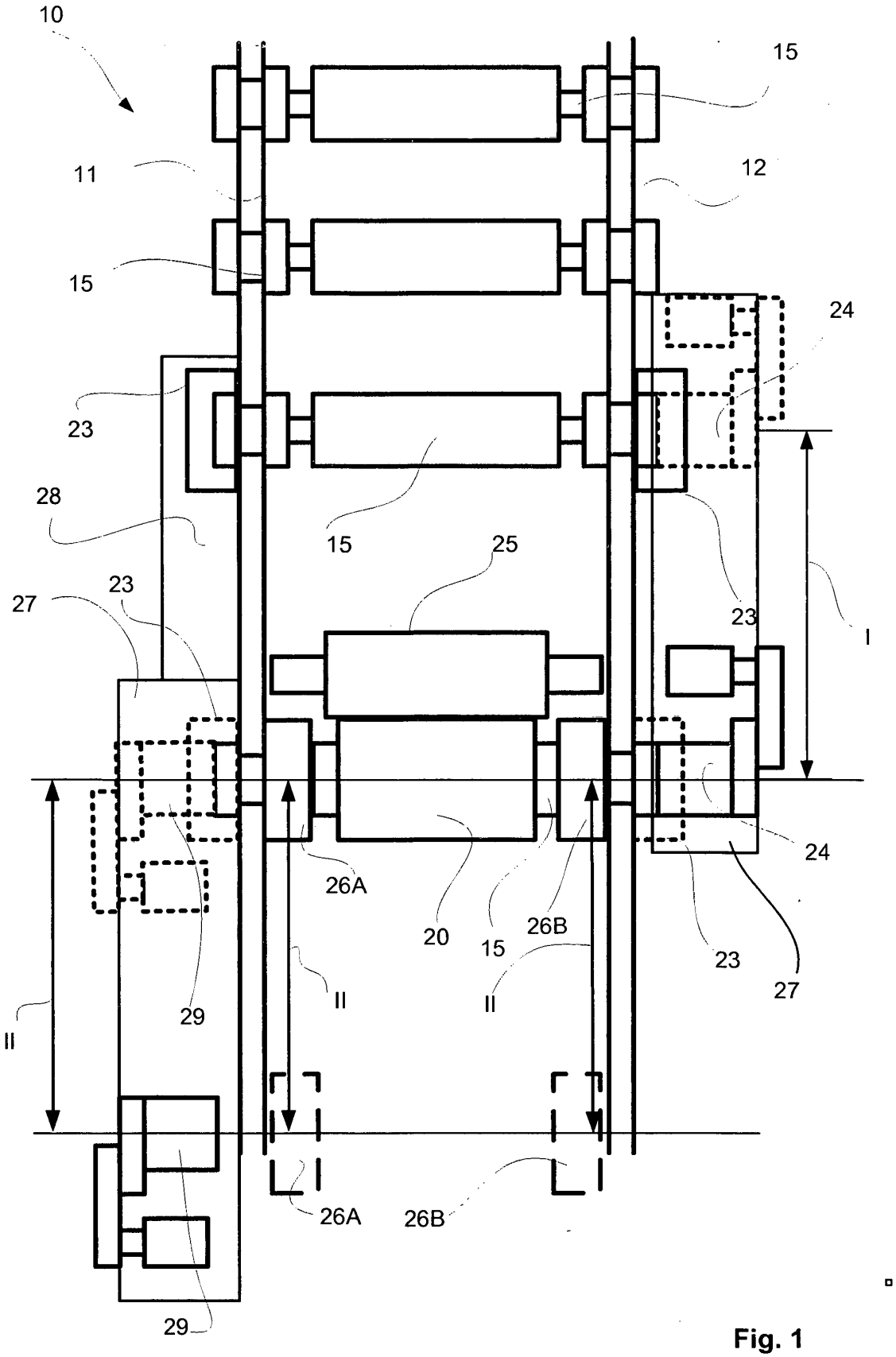

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I
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26A
20
15
26B
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27
29
II
II
II
26A
26B
29

Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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