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(54) **Slitter positioning arrangement of a slitter-winder of a fiber web production line**

(57) The invention relates to a slitter positioning arrangement of a slitter-winder of a fiber web production line, which is located in a slitting section of the slitter winder for slitters (10A, 10B) forming slitter pairs of a bottom slitter (10A) and a top slitter (10B), which slitting section comprises frame beams (20A, 20B) for slitters (10A, 20B) on support of which each slitter (10A, 10B) is positionable and movable by carriages (11 A, 11 B) on guides. Each carriage for slitters (10A, 10B) is provided with a motor (17A, 17B) and the slitter positioning arrangement comprises a support element (19A, 19B) and forms a slitter support module with the slitter carriages (11 B, 11 B), which slitter support module can be pre-assembled and then assembled onto the frame beam of the slitter-winder. The invention also relates to a method for rebuild of a slitting section of a slitter-winder, in which method the slitter positioning arrangement is provided and the support element (19A, 19B) is assembled onto the frame beams of the slitting section of the slitter-winder to be rebuilt as a pre-assembled slitter support module. The invention also relates to a method for edge trimming of a fiber web in a slitter-winder comprising the slitter positioning arrangement, in which method the edge trimming is done while the partial webs are still moving and the slitter-winder is slowed down for the trim change by moving outermost slitters in cross direction at both edges of the web to the next position for the next trim of customer rolls.

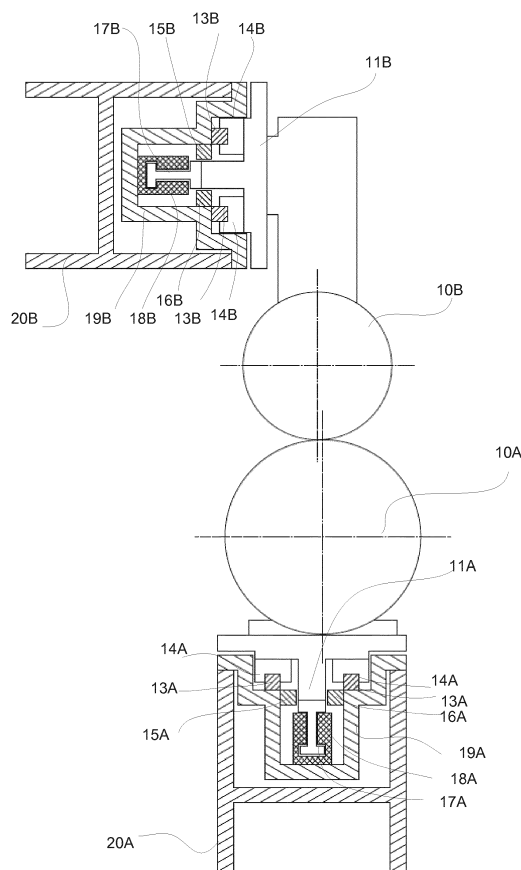


Fig. 2

Description

[0001] The present invention relates to a slitter-winder of a fiber web production line in general and in particular to a slitter positioning arrangement of a slitter-winder of a fiber web production line according to the preamble part of claim 1.

[0002] It is known that a fiber web, e.g. paper, is manufactured in machines which together constitute a paper-manufacturing line which can be hundreds of metres long. Modern paper machines can produce over 450,000 tons of paper per year. The speed of the paper machine can exceed 2,000 m/min and the width of the fiber web can be more than 11 metres.

[0003] In paper-manufacturing lines, the manufacture of paper takes place as a continuous process. A fiber web completing in the paper machine is reeled by a reel-up around a reeling shaft i.e. a reel spool into a parent roll the diameter of which can be more than 5 metres and the weight more than 160 tons. The purpose of reeling is to modify the fiber web manufactured as planar to a more easily processable form. On the reel-up located in the main machine line, the continuous process of the paper machine breaks for the first time and shifts into periodic operation.

[0004] The web of parent roll produced in paper machine is full-width and even more than 100 km long so it must be slit into partial webs with suitable width and length for the customers of the paper mill and wound around cores into so-called customer rolls before delivering them from the paper mill. This slitting and winding up of the web takes place as known in an appropriate separate machine i.e. a slitter-winder.

[0005] On the slitter-winder, the parent roll is unwound, the wide web is slit on the slitting section into several narrower partial webs which are wound up on the winding section around winding cores, such as spools, into customer rolls. When the customer rolls are completed, the slitter-winder is stopped and the wound rolls i.e. the so-called set is removed from the machine. Then, the process is continued with the winding of a new set. These steps are repeated in sequences periodically until paper runs out of the parent roll, whereby a parent roll change is performed and the operation starts again as the unwinding of a new parent roll.

[0006] In the slitter-winders of fiber web machines a fiber web is slit in the longitudinal direction into several partial webs with rotating shear slitters, which form a slitter pair, comprising a top slitter blade and a bottom slitter band. The bottom slitter band with an adapter is mounted on a shaft of an AC-drive motor and its counter slitter, the top slitter blade, is mounted on a separate top slitter holder.

[0007] From now on in this document with term "top slitter" is meant top slitter blade with top slitter holder and with term "bottom slitter" is meant bottom slitter band with its drive motor. Term "slitter" means either "top slitter" or "bottom slitter" and in plural "slitters" both slitters.

[0008] The width of the partial webs to be slit by the slitters and thus the position of the slitters can vary to a great extent when different trim settings are used, depending on the set widths of the rolls to be produced.

5 The slitters have to be positioned and moved, in the cross direction of the web, into the right slitting position corresponding to the desired roll widths. In order to produce partial webs of the desired width the slitters of the slitter-winder are spaced apart as desired in the cross direction of the paper or board web, i.e. a trim change is carried out.

10 **[0009]** Different types of arrangements have been used in known slitter-winders for moving the slitters to the correct slitting position. It is known to use slitter positioning equipment, in which transfer bars with one or two gear jacks driven by a motor are used to move all slitter pairs. The slitter carriages, on which slitters are mounted, will grip to the transfer bars and the transfer bars are moved in reciprocating motion in their operating area. It also known to use slitter positioning equipment based on a cogged belt or a wire rope, which is moved and the slitter carriages are attached to it. Additionally it is known to provide each slitter carriage with its own transfer device that takes care of moving the slitter to the desired position. During recent years in many paper and board mills it has shown that order sizes have decreased and thus the need for trim changes, i.e. positioning and moving slitters, have increased. Thus significance of the time needed for positioning and moving the slitters into desired position for the next trim of customer rolls has increased and even for machines already in use faster slitter positioning equipment are needed, i.e. the slitter-winder needs to rebuild, since typically in older slitter-winders the time needed for positioning and moving the slitters into the new slitting position has been about one minute or even more. Rebuild of slitter-winders has typically been accomplished by disassembling at least the slitting section with its frame parts and assembling new frame structures and slitting section to the slitter-winder.

30 **[0010]** It is known of prior art to measure the position of slitters used in slitting by means of a carriage-type arrangement, in which a sensor is placed in a moving carriage via which sensor, by optic or magnetic measurement, the position of the slitters has been established. The magnetic measurement for positioning has been widely used in known slitting sections of slitter-winders even though it is sensitive to dust and any foreign matter entering the area of sensors. These measurement methods are used in connection with the trim changes.

35 **[0011]** In EP patent publication 1390180B1 is disclosed a method for positioning slitters of a slitter-winder and in CN publication 102729286 is disclosed an automatic slitter positioning system.

40 **[0012]** In DE application publication 102007047890 is disclosed a device that has a magnetic measuring system, in which the position detection devices are connected with the carriages of the slitters, and a magnetic band extends over the path for the carriages. Each slitter has its own carriage and the carriages for top slitters have a

common drive unit with a drive and a transmission unit.

[0013] In DE application publication 102007000685 is disclosed an arrangement for position determining of slitters of a slitter-winder in which the position determining device comprises a magnetostrictive measuring system integrated in the guides of the slitter carriers.

[0014] In EP publications 1716985A1 and 1935818B1 are disclosed slitter-winders, in which energy transmission is provided by sliding contact element for the energy supply of the slitters in EP 1716985A1 and of the winding stations in EP 1935818B1. In EP 1716985A1 also the information transmission is provided by sliding contact element.

[0015] The edge trim remaining at the edge of the fiber web is guided through an edge trim chute into a pulper. In connection with the trim change, when the position of slitters changes in the slitter-winder, the width of the edge trim may, of course, also change. As known in the state of the art, the untrimmed neck remaining between the edge trims according to a new and an old trim has been torn manually in order to enable the edge trim to be passed through the edge trim chute into the pulper. As the removal of the neck between the edge trims slit in accordance with a new and an old trim by tearing a piece of web out of said point, as described above, has been a manual operation, with the result that the other duties associated with the operation of the slitter-winder are interrupted and the slitter-winder cannot start until the neck has been removed. This reduces the production capacity of the slitter-winder. In addition, another worker has often been needed to perform this operation which must be done by hand. This manual operation is also a risk in terms of work safety, because it is performed in a dangerous place close to slitter blades.

[0016] It is an object of the invention to provide a slitter positioning arrangement of a slitter-winder of a fiber web production line for eliminating or at least minimizing the disadvantages described above.

[0017] An object of the invention is to provide an easy-to-use and reliably operating slitter positioning arrangement of a slitter-winder of a fiber web production line.

[0018] An object of the invention is to provide a slitter positioning arrangement of a slitter-winder of a fiber web production line that is in particular suitable for rebuild of a slitting section of an already existing slitter-winder.

[0019] Another object of the invention is to accomplish rebuild of a slitter-winder as fast as possible and requiring as little changes as possible.

[0020] In order to achieve the above objects the slitter positioning arrangement of a slitter-winder of a fiber web production line according to the invention is mainly characterized by the features of claim 1.

[0021] Additional advantageous features of the slitter positioning arrangement are presented in the dependent claims.

[0022] According to an advantageous aspect the invention the slitter positioning arrangement comprises a support element for guides and advantageously also po-

sition-measurement means, which forms a slitter support module with the slitter carriages. The guides and advantageously a magnetic track for linear motors and the position-measurement means are constructed as parts of the slitter support module such that an independent unit is formed. The slitter support module can be pre-assembled and tight tolerances can be used. The independent pre-assembled slitter support modules are then assembled onto the frame beams of the slitter-winder in connection with rebuild of the slitting section of the slitter-winder. The frame beams of slitting section of the slitter-winder can be used as such, since the support element provides for the assembling joint surfaces and accuracy needed and thus it is in-built to the slitter support module.

[0023] As the slitter support module can be pre-assembled already before it is taken to the slitter-winder to be rebuilt, the testing and adjusting can be done also in connection with the pre-assembling work.

[0024] The slitter carriages of the slitters are bearing mounted on the support element and the slitters are supported on the carriages in the manner known as such to one skilled in the art.

[0025] According to an advantageous aspect the slitter positioning arrangement comprises a stand-alone control system, which thus needs no adapting work to other control systems of the slitter-winder or to the fiber web machine.

[0026] According to an advantageous feature of the invention the slitter positioning arrangement comprises in the slitter support module slitter carriages with a linear motor as the motor for moving the slitter carriages with high speed; typically the speed is 200 - 1000 mm/s. Each slitter carriage for top and bottom slitter comprises its own linear motor and thus the time needed for positioning and moving the slitters to next slitting position for the next trim of customer rolls is reduced to 5 seconds and even less. The magnetic track for the linear motors is extending in cross direction, i.e. in longitudinal direction of the support element, and located in the slitter support element.

[0027] According to another advantageous feature the motor is an electric motor by which the time needed for positioning and moving the slitters to next slitting position for the next trim of customer rolls can also be reduced to 5 seconds and even less. When electric motors or other types of motors other than linear motors are used, no magnetic tracks are needed in the slitter support module.

[0028] According to an advantageous feature the support element is made of steel.

[0029] According to an advantageous feature protective bellows between adjacent slitter carriages are located to close the support element such that the operating parts inside the support element are protected from dust and other foreign particles.

[0030] According to an advantageous feature the energy transmission to the carriages of the slitters is provided by spiral cable draws or by energy transfer chains or by bus bars.

[0031] Advantageously the position measurement

means are optical or capacitive measurement means.

[0032] Method for rebuild of a slitting section of a slitter-winder is characterized by features of claim 13.

[0033] The new construction of slitters' support as the slitter support module using the support element makes it also possible to use a new method for edge trimming. The method for edge trimming of a fiber web in a slitter-winder is characterized by features of claim 14. According to the new method the edge trimming is done while the partial webs are still moving, when the machine is slowed down for the set change and the trim change. The outermost slitters in cross direction at both edges of the web are moved to the next position for the next trim of customer rolls and thus the edge trimming is achieved simultaneously and the operator does not need to go to the slitting section for manual edge trimming and thus time is saved.

[0034] The invention and its further objects, features and advantages may be more fully understood by reference to the following drawings.

[0035] In figure 1 is shown a schematical example of a slitting section of a slitter-winder in accordance with prior art.

[0036] In figure 2 is shown schematically an example of a slitting section of a slitter winder according to an advantageous example of the invention.

[0037] In figure 3 is shown schematically another example of a slitting section of a slitter winder according to an advantageous example of the invention.

[0038] During the course of this description like numbers and signs will be used to identify like elements according to the different views which illustrate the invention. Typically in slitter-winders the slitters are in pairs, one top slitter and one bottom slitter form a pair of slitters. Each pair slits one longitudinal cut to the fiber web. It should be noted that the terms top and bottom do not necessarily have any correspondence to the location of the slitters in the slitting section of the slitter-winder; it can be that the top slitter is actually in reality below the bottom slitter. In this description and in the figures parts and part components and component assemblies relating to the bottom slitter are indicated by letter A after the corresponding reference numeral and parts relating to the top slitter are indicated by letter B after the corresponding reference numeral.

[0039] In figure 1 is an example of a slitting section of a slitter-winder according to prior art. The slitting section comprises a frame beam 20A for bottom slitters 10A and a frame beam 20 B for top slitters 10B. The frame beams 20A, 20B extend longitudinally in cross section of the web. Each frame beam 20A; 20B comprises guides 21 A, 22A, 21 B, 22B for slitter carriages 11 A; 11 B of the slitters 10A; 10B. One of each guide pair 21 A, 22A; 21 B, 22B is a round bar 22A, 22B and the other one of each guide pair 21 A, 22A; 21 B, 22B is a flat bar 21 A, 21 B. It is clear to one skilled in the art that the guides can be of different types and/or designs. For accurate positioning of slitter pairs 10A, 10B these guides are made under

tight tolerances. For positioning and moving the slitter pairs 10A, 10B to the next slitting position for the next trim of customer rolls, the slitter pairs 10A, 10B are moved in their carriages 11 A, 11 B along the guides 21 A, 22A; 21 B, 22B.

[0040] In the example of figures 2 each slitter 10A, 10B is supported on the slitter carriage 11 A, 11 B. For top slitters 10B in the slitting section is upper frame beam 20B and for bottom slitters 10A is lower frame beam 20A. A support element 19A, 19B is supported on the frame beam 20A, 20B. The support element 19A, 19B is a longitudinally in extending profile type element that has a generally U-type form with collars 31 A, 31 B, by which the support element 19A, 19B is supported to the frame beam 20A, 20B. The support element also has shoulders 32A, 32B. Each slitter carriage 11 A, 11 B has its own motor 17A, 17B, which in this example is a linear motor 17A, 17B located movably on a magnetic track 18A, 18B for the linear motors 17A, 17B. The magnetic track 18A, 18B is located onto the bottom of the generally U-formed support element 19A, 19B. When electric motors or other types of motors other than linear motors are used, no magnetic tracks are needed in the slitter support module. Linear guides 13A, 13B for the linear bearings 14A, 14B of the carriages 11 A, 11 B are located on the shoulders 32A, 32B of the support element 19A, 19B. Furthermore inside the support element 19A, 19B is located a brake 15A, 15B for stopping the corresponding carriage 11 A, 11 B and a position measurement means 16A, 16B for defining the correct position of the slitters 10A, 10B. The energy transmission to the carriages 11 A, 11 B of the slitters 10A, 10B is provided by spiral cable draws or by energy transfer chains or by bus-bars. The position measurement means 16A, 16B are optical or capacitive.

[0041] The example in the figure 3 is similar with the example in figure 2 and the only difference is that in figure 3 is shown bellows 12A, 12B, which is located between adjacent slitter carriages on top part of the support element 19A, 19B for protecting the inside of the support element 19A, 19B against dust and foreign particles.

[0042] As shown in figures 2 and 3 the support element 19A, 19B and the slitter carriage 11A, 11B with the motor 17A, 17B, the guides 13A, 13B, the brake 15A, 15B and the position-measurement means 16A, 16B form a slitter support module. The guides 13A, 13B, the brake 15A, 15B and the position-measurement means 16A, 16B are constructed as parts of the support element 19A, 19B in the slitter support module such that an independent unit is formed.

[0043] The independent pre-assembled slitter support module is assembled onto the frame beam 20A, 20B of the slitter-winder in connection with rebuild of the slitting section of the slitter-winder. In case the slitter-winder is the type presented in figure 1 the flat and the round bars 21 A, 22A; 21 B, 22B are removed from the frame beam 20A, 20B and the support element 19A, 1 B is located into support of the frame beam 20A, 20B. The frame beam 20A, 20B of the slitting section of the slitter-winder

can be used as such, since the support element 19A, 19B provides for the assembling needed accuracy and joint surfaces.

Reference signs used in the drawing

[0044]

10A, 10B	slitter	
11A, 11B	slitter carriages	
12A, 12B	bellows	
13A, 13B	linear guides	
14A, 14B	linear bearings	
15A, 15B	brakes	
16A, 16B	position measurement means	
17A, 17B	linear motors	
18A, 18B	magnetic tracks	
19A, 19B	support elements	
20A, 20B	frame beams	
21A, 21B	flat bars	
22A, 22B	round bars	
31A, 31B	collars	
32A, 32B	shoulders	

Claims

1. Slitter positioning arrangement of a slitter-winder of a fiber web production line, which is located in a slitting section of the slitter winder for slitters (10A, 10B) forming slitter pairs of a bottom slitter (10A) and a top slitter (10B), which slitting section comprises frame beams (20A, 20B) for slitters (10A, 20B) on support of which each slitter (10A, 10B) is positionable and movable by carriages (11 A, 11B) on guides, **characterized in that** each carriage for slitters (10A, 10B) is provided with a motor (17A, 17B) and **that** the slitter positioning arrangement comprises a support element (19A, 19B) and forms a slitter support module with the slitter carriages (11 B, 11 B), which slitter support module can be pre-assembled and then assembled onto the frame beam of the slitter-winder.

2. Slitter positioning arrangement according to claim 1, **characterized in that** the slitter support module is pre-assembled and then assembled onto the frame beam of the slitter-winder in connection with rebuild of the slitting section of the slitter-winder.

3. Slitter positioning arrangement according to claim 1 or 2, **characterized in that** the slitter positioning arrangement comprises a brake (15A, 15B) and position-measurement means (16A, 16B) located in the slitter support element (19A, 19B).

4. Slitter positioning arrangement according to any of claims 1 - 3, **characterized in that** the slitter carriages (11A, 11 B) of the slitters (10A, 10B) are bearing-mounted on the support element (19A, 19B) and movable on linear guides (13A, 13B) provided in the support element (19A, 19B) by linear bearings (14A, 14B).

5. Slitter positioning arrangement according to any of claims 1 - 4, **characterized in that** the slitter transfer arrangement comprises a stand-alone control system.

6. Slitter positioning arrangement according to any of claims 1 - 5, **characterized in that** the motor (17A, 17B) is a linear motor for moving the slitter carriages (11A, 11B) with high speed.

7. Slitter positioning arrangement according to any of claims 1 - 5, **characterized in that** the motor (17A, 17B) is an electric motor for moving the slitter carriages (11 A, 11B) with high speed.

8. Slitter positioning arrangement according to claim 6, **characterized in that** the slitter positioning arrangement comprises a magnetic track (18A, 18B) for the linear motors (17A, 17B), which magnetic track is located in the slitter support element (19A, 19B).

9. Slitter positioning arrangement according to any of claims 1 - 8, **characterized in that** protective bellows (12A, 12B) between adjacent slitter carriages are located to close the support element (19A, 19B) such that inside of the support element are protected from dust and other foreign particles.

10. Slitter positioning arrangement according to any of claims 1 - 9, **characterized in that** energy transmission to the carriages (11A, 11 B) of the slitters (10A, 10B) is provided by spiral cable draws or by energy transfer chains or by bus bars.

11. Slitter positioning arrangement according to claim 3, **characterized in that** the position measurement means (16A, 16B) are optical or capacitive measurement means.

12. Slitter positioning arrangement according to any of claims 1-11, **characterized in that** the support element (19A, 19B) is a longitudinally extending profile type element that has a generally U-type form with collars (31 A, 31 B), by which the support element 19A, 19B is supported to the frame beam 20A, 20B and that the support element has shoulders (32A, 32B). 5
13. Method for rebuild of a slitting section of a slitter-winder, in which method a slitter positioning arrangement according to any of the previous claims is provided, **characterized in that** the support element (19A, 19B) is assembled onto the frame beams of the slitting section of the slitter-winder to be rebuilt as a pre-assembled slitter support module. 10 15
14. Method for edge trimming of a fiber web in a slitter-winder comprising a slitter positioning arrangement according to any of previous claims, in which method the edge trimming is done while the partial webs are still moving and the slitter-winder is slowed down for the trim change by moving outermost slitters in cross direction at both edges of the web to the next position for the next trim of customer rolls. 20 25

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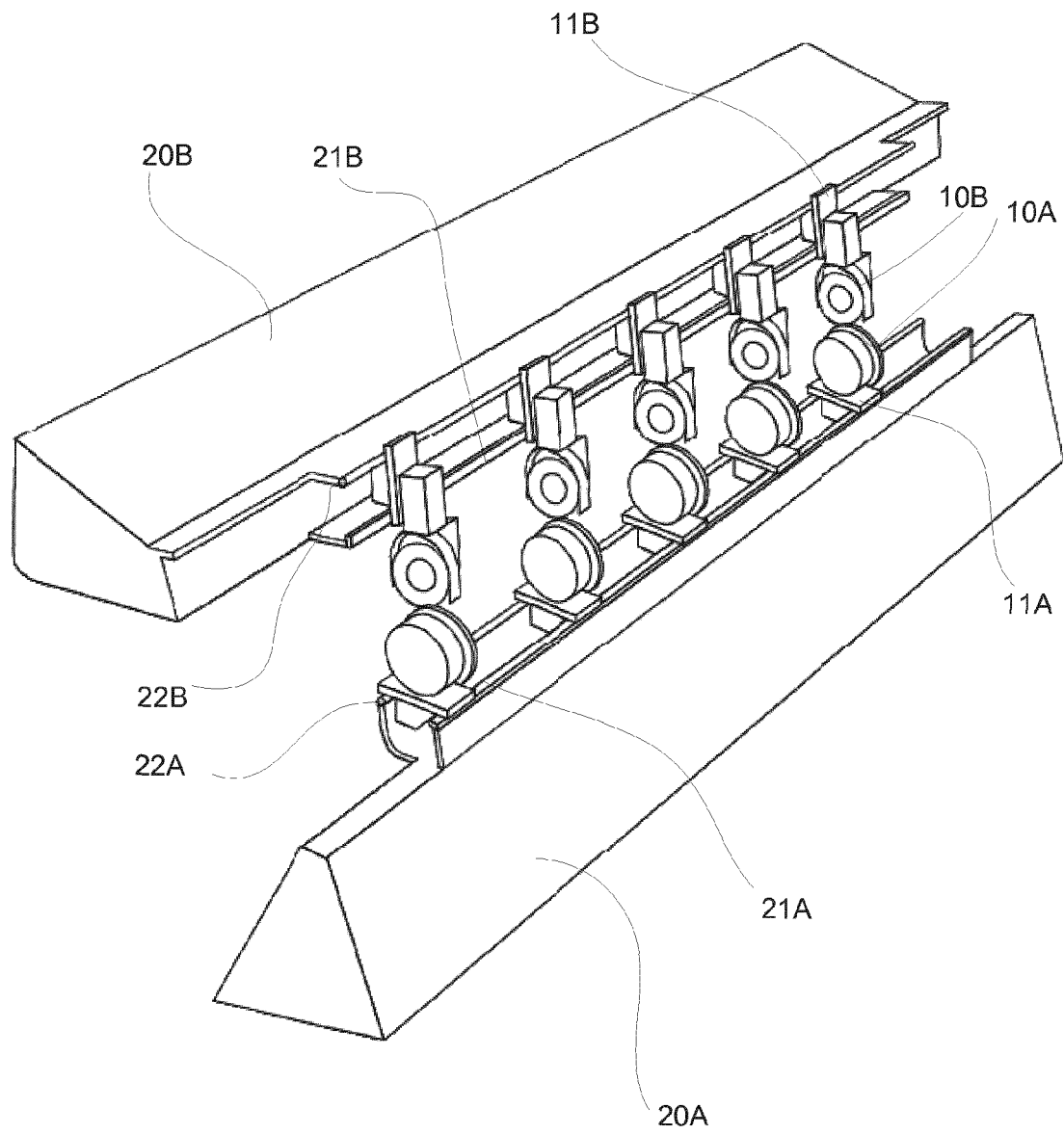


Fig. 1 prior art

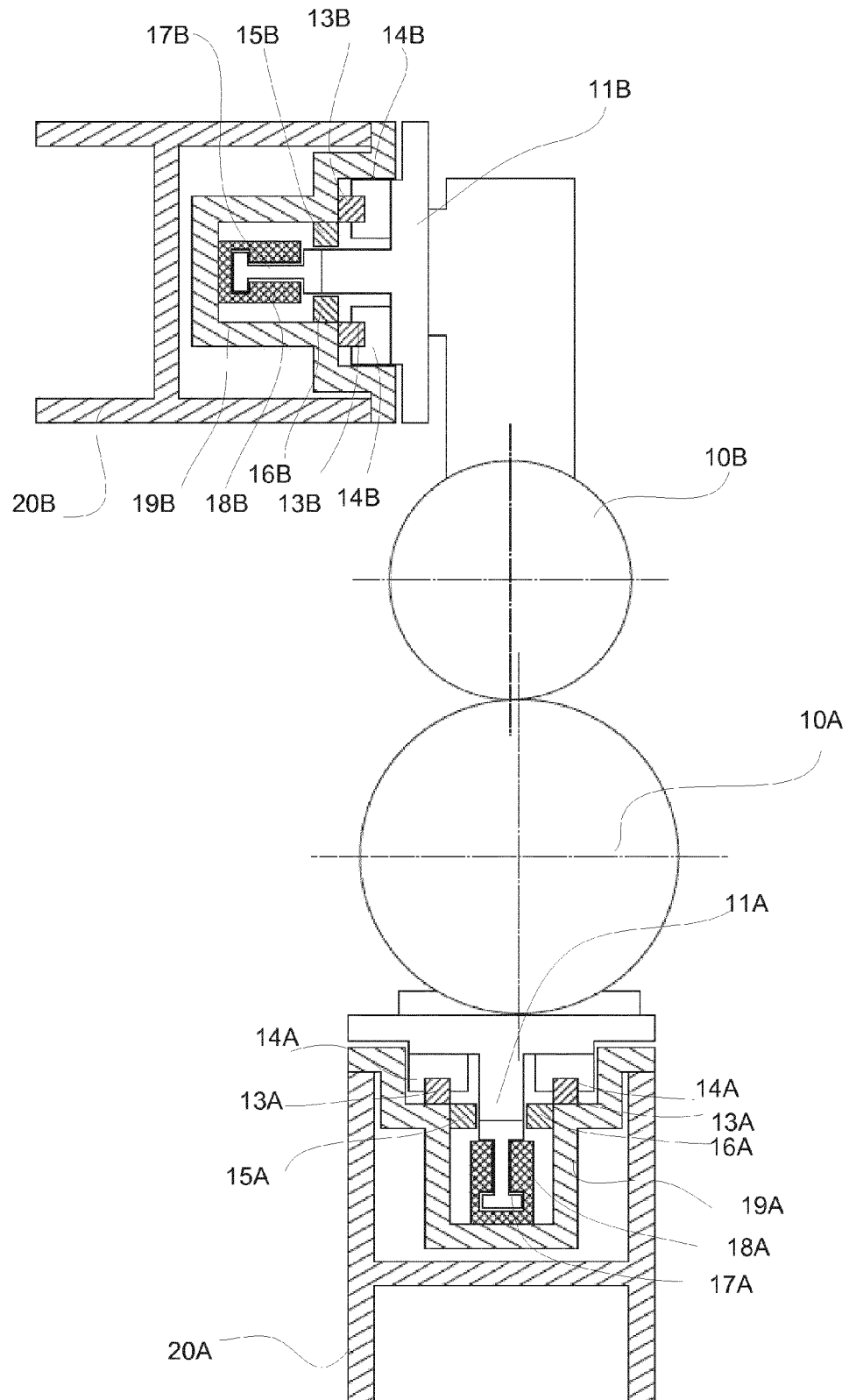


Fig. 2

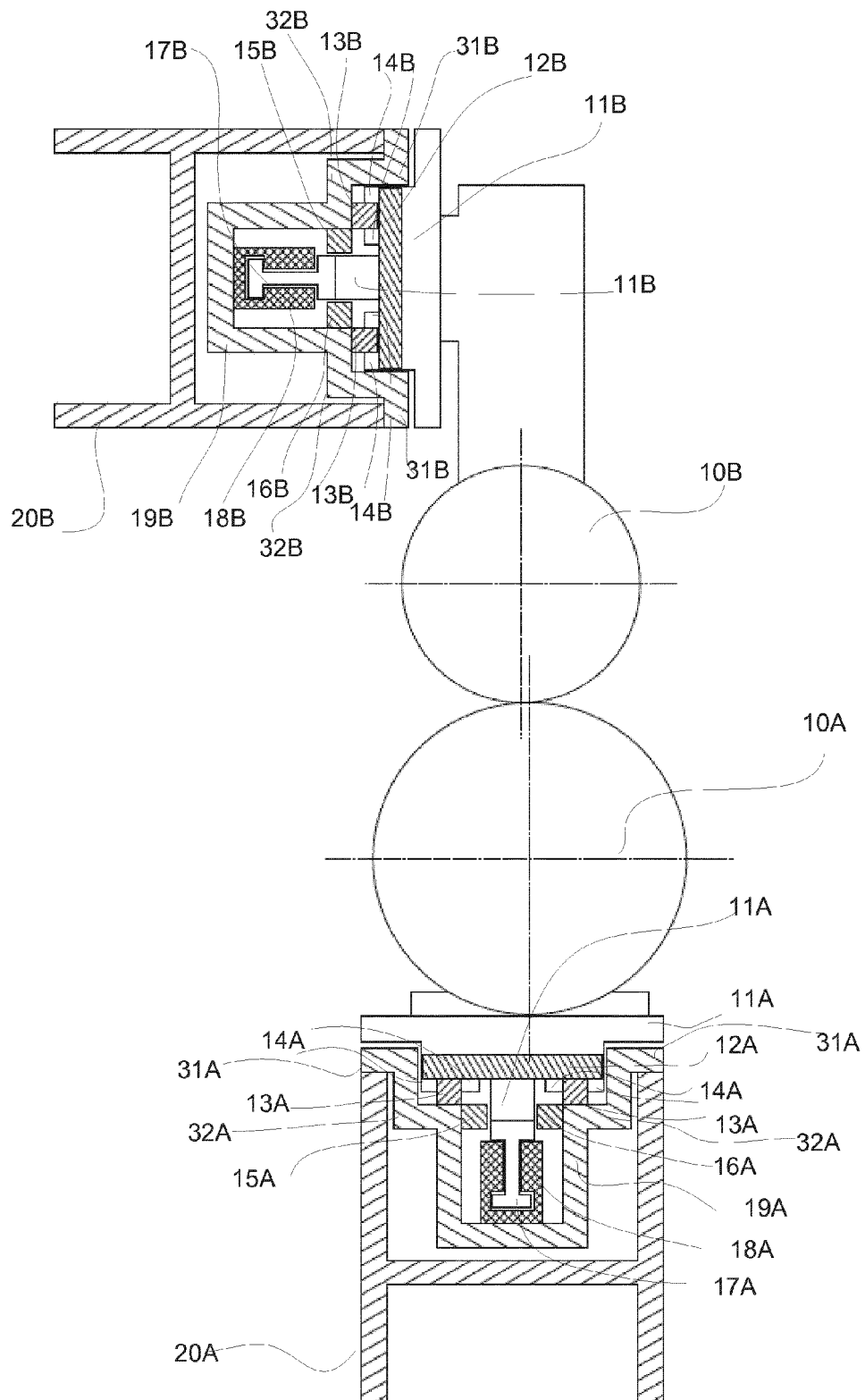


Fig. 3



EUROPEAN SEARCH REPORT

 Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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