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(54) **New configurations for hydraulic machines**

(57) A hydraulic generator for converting falling water into energy, comprising at least one first conveyor member (1) and a second conveyor member (2), wound around a series of wheels or pulleys and each operating in closed circuit and along a certain path with a difference in height, where each of the conveyors comprises a series of containers water (15) and also comprises, along the respective closed path, at least one zone for filling containers with water and a zone in which water is discharged, located at a lower height with respect to the filling zone, and in which said conveyors cooperate so as to actuate at least one user device.

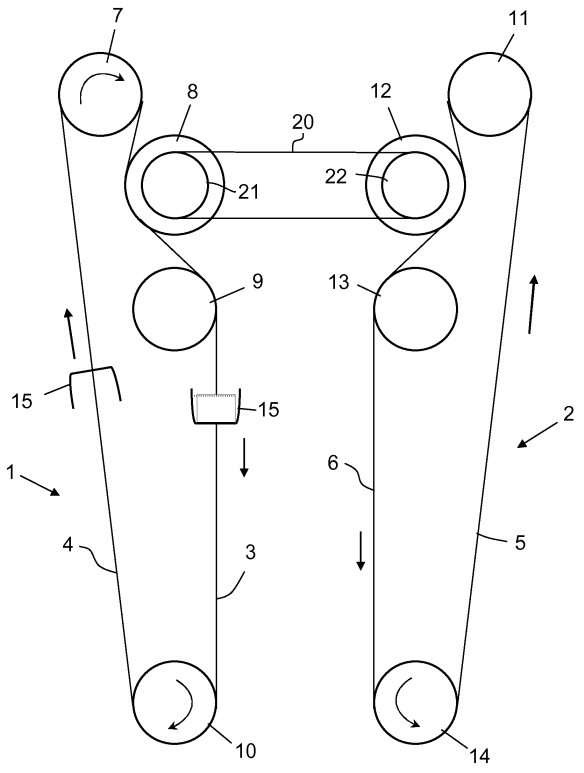

FIG. 1

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Description

Field of Application

[0001] The invention concerns the field of hydraulic machines, capable of converting falling water into mechanical energy and, through a generator, into electrical energy.

Prior art

[0002] It is well known that hydraulic energy is a clean renewable source of energy, without any emission into the atmosphere or other environmental impact. Therefore it is particularly interesting and there is a strong incentive to try to maximize its exploitation. There is also a growing interest in the so-called microgeneration that is the realization not only of large plants, but also of small plants (for example household plants) that are capable of widely exploiting this resource.

[0003] Known hydraulic machines are substantially based upon the use of a turbine, which can have various configurations according to the available fall and to the flow rate of water. However, the turbine plants cannot always be applied especially in the low power range.

[0004] Hydraulic machines have also been proposed that are based upon a different concept, i.e. a chain with a closed path, wound around pulleys or gear wheels, which has a series of water recipients which are cyclically filled and emptied out. The invention proposes a series of new configurations for hydraulic machines of this type.

Summary of the invention

[0005] A hydraulic generator is proposed comprising at least a first conveyor member and a second conveyor member, which are wound around a series of wheels or pulleys and each operate in a closed circuit and along a predetermined path having a difference in height. Each of the conveyors comprises a series of containers for water and also comprises, along the respective closed path, at least one zone for filling containers with water and a zone in which water is discharged from the containers themselves, said discharge zone being located at a lower height with respect to the filling zone. Said conveyors moreover cooperate so as to actuate at least one user device.

[0006] Preferably it is desirable to maximise the difference in height between the filling zone and the zone in which water is discharged. Each of the conveyors therefore has an active descending stroke between said filling and expulsion zones, during which mechanical energy is extracted. The empty recipients then follow a return ascending stroke.

[0007] Advantageously, each of the conveyors is essentially formed by two or more parallel chains, which are wound around pairs or groups of coaxial wheels or pulleys. The water containers can be in the form of cylindrical containers, buckets or pails. Preferably said containers are suitably pivoted, for example around an axis that is fixedly attached to said chains, so as to allow a tipping motion and, therefore, the automatic discharge of water at the end of the active stroke. The tipping motion can be caused by the weight itself or can be guided.

[0008] In a preferred embodiment, the generator comprises a plurality of conveyors the paths of which are substantially arranged on parallel planes. More advantageously, said conveyors on parallel planes engage at least one group of coaxial wheels or pulleys with increasingly greater diameter. The conveyors guided by the larger wheels can mount larger containers whereas the others, wound on increasingly smaller wheels, mount smaller containers. The inventor has found that in such a manner a particular compactness and efficiency are achieved in relation to the dimensions of the machine.

[0009] According to a particularly preferred embodiment, the machine comprises at least one first conveyor actuated by wheels with a first diameter, a second conveyor actuated by wheels with a second diameter, that is different from the first diameter, and possibly other conveyors with wheels with yet another diameter. The wheels of the various conveyors form respective groups of coaxial wheels, in which the wheels have diameters that increase from a smaller inner wheel to a larger outer wheel. Also the water containers, correspondingly, have different sizes for the various conveyors.

[0010] Other preferred features are described in the attached dependent claims. Said features, together with the advantages of the present invention, shall become clearer from the following description, given as an example and not for limiting purposes, and with the help of the attached figures.

Detailed description

[0011] Fig. 1 schematically shows a first embodiment. It comprises two closed circuit conveyors generally indicated with reference numerals 1, 2. The conveyor 1 essentially comprises a descending portion 3 that represents the active stroke, and an ascending (or return) portion 4. Similarly, the conveyor 2 comprises a descending portion 5 and an ascending portion 6. The conveyors are moved by groups of pulleys or gear wheels 7-10 and 11-14 respectively. In the rest of the description they shall be generically named wheels.

[0012] Each of the conveyors 1, 2 carries a series of water containers 15 which are filled at a certain height, preferably while passing around the wheel 7 or 11 that is at the zone of maximum height, and empty at a lower height, preferably while passing around the lower wheel 10 or 14. For the sake of simplicity Fig. 1 shows only two of the containers associated with the conveyor 1, respectively in the portion 3 (descending) and 4 (ascending). The arrows of the figure indicate the conveying direction.

[0013] The containers 15 can be shaped like substantially cylindrical pails or buckets, even though other

shapes are possible. The water discharge from the containers 15 preferably occurs with a tipping over of the containers which are for example pivoted to an axis that is fixedly attached to the conveyor 1 or 2. The tipping over can be determined by the weight of the container 15 itself or guided by suitable means, for example bearings associated with the container that engage fixed guides, the latter being fixedly attached to the frame of the machine (not shown).

[0014] Preferably the conveyors are essentially formed by two or more adjacent chains, and the wheels 7-14 are meant to be pairs or groups of wheels. Fig. 2 for example represents a detail of the conveyor 1 in the proximity of the group of wheels 7. It should be noted that the conveyor 1 essentially comprises two parallel chains 1a, 1b that engage with a pair of wheels 7a, 7b of the aforementioned group 7. Moreover, one of the containers 15 and the relative support and tipping axis 15a is schematically shown, which can be for example a metal bar that is fixed to the chains 1 a, 1b and with respect to which the container 15 is pivotable.

[0015] It is clear, going back to Fig. 1, that the device is capable of generating useful mechanical energy by exploiting the difference in height between the upper part of the machine (at the wheels 7, 11) and the lower part (at the wheels 10, 14), i.e. converting the potential energy of the water loaded in the containers 15 into mechanical energy. In this case, the conveyors 1, 2 cooperate so as to actuate a user device formed by a chain or belt 20 wound around wheels 21, 22 coaxial to the wheels 8, 12 and fitted onto the same shaft. Said wheels 21, 22 in turn can drive a generator of electrical energy or other user device.

[0016] Figs. 3 and 4 show another configuration of the machine. A plurality of conveyors operate on parallel planes and wind around at least one group of coaxial wheels, characterised by increasing diameters from a smaller inner to a larger outer wheel. Thanks to the coaxial wheels with different diameters, containers having different sizes can be used as is clear in Fig. 4, without problems of mechanical interference. One advantage of such a configuration comes from its compactness in relation to the obtainable power, having different conveyors that work in parallel in a small space and therefore are capable of handling a greater flow rate for the same available difference in height.

[0017] In greater detail, the figures show an example in which there are three conveyors 30, 31 and 32. They have two chains each, for example the chains 30a and 30b that form the conveyor 30 are indicated. The conveyors wind around four groups of coaxial wheels. For the sake of simplicity a group 33 is indicated comprising (in the example) three wheels 34, 35 and 36 respectively of a minimum, intermediate and maximum diameter.

[0018] It should be noted that, due to the arrangement on parallel planes, the conveyors can be equipped with containers (pails) of increasing size 37, 38 and 39, going, in order, from the innermost conveyor 30 to the outermost 32. One advantage comes from the compactness and greater amount of energy produced for the same size.

[0019] One variant is shown in Fig. 5 in which there is again a plurality of conveyors 30, 31 and 32 on parallel planes; in this case however only the group of upper wheels 33 is coaxial, whereas the remaining wheels indicated with reference numerals 40 to 44, are arranged with parallel axes and no longer coaxial. In this case the wheels can also have the same dimension being no longer necessary to have different diameters as described previously.

[0020] Another optional feature of the invention is shown in Fig. 6. Here the same reference numerals as Fig. 1 have been used, indicating with reference numeral 1 the conveyor, with reference numeral 3 the relative descending portion and with reference numeral 4 the ascending portion. Along the descending portion 3 a guiding means 50 is arranged, for example obtained with a tube, which has the advantage of guiding the descent of the containers 15 while keeping the verticality. More advantageously, it has an upper part 51 that is funnel-shaped so as to act also as a means for distributing water, indicated with the symbol W. It should be noted that the upper opening of the container 15 is indicated with 15b.

[0021] Fig. 7 also shows a further advantageous provision. The conveyor, again indicated with reference numeral 1, comprises a certain number of main wheels, for example the two wheels 60, 61 shown, and also comprises an auxiliary wheel 62 which straightens the containers 15 after overturning and discharge of water (which substantially occurs when passing around the lower wheel 61), bringing the same containers 15 back to the normal disposition (not tipped over) for being filled and subsequently descent.

[0022] Also in the configurations of Figs. 2-7, as clear to a man skilled in the art, at least one of the wheels actuates a user device like the device 20 of Fig. 1.

[0023] The new configurations that have been described overcome the limitations of the prior art and make this type of hydraulic machine convenient for generation of clean energy.

Claims

1. Hydraulic generator for converting falling water into energy, comprising at least a first conveyor member (1) and a second conveyor member (2), wound around a series of wheels or pulleys (7-14) and each operating in a closed circuit and along a certain path having a difference in height, wherein each of the conveyors comprises a series of water containers (15) and moreover comprises, along the respective closed path, at least one zone for filling containers with water and a zone in which water is discharged located at a lower height with respect to the filling zone, and wherein said conveyors cooperate so as to actuate at least one user device (20).

2. Generator according to claim 1, wherein each of the conveyors is essentially formed by two or more parallel chains (1 a, 1 b), wound around pairs or groups of coaxial wheels or pulleys (7a, 7b).

3. Generator according to claim 2, the water containers being cylindrical and pivoted to an axis (15a) fixedly attached to the chains, allowing for the container to be tipped over for discharging water at the end of an active descending stroke.

4. Generator according to any one of the previous claims, comprising a plurality of conveyors (30, 31, 32) the paths of which are substantially arranged on parallel planes.

5. Generator according to claim 4, comprising at least a first conveyor (30) actuated by wheels with a first diameter (34), and a second conveyor (31, 32) actuated by wheels with a second diameter (35, 36), that is different from the first, and wherein the wheels of the conveyors, in at least one point of the parallel paths of the conveyors, form a group of coaxial wheels (33) with diameters that increase in size from a smaller inner wheel (34) to a larger outer wheel (36).

6. Generator according to claim 5, wherein the conveyors are equipped with containers also having increasing size (37, 38, 39) corresponding, in order, to the increasing size of their actuation wheels or pulleys (34-36).

7. Generator according to any one of the previous claims, wherein a guiding means (50) is arranged, substantially in the form of a tube, for guiding the containers for water (15) down along at least one descending portion of path.

8. Generator according to claim 7, wherein said tube-shaped guiding means (50) has an open funnel-shaped upper part (51) so as to also act as means for distributing water into the containers (15) that enter the tube itself.

9. Generator according to any one of the previous claims, wherein water is discharged by tipping over the containers suitably pivoted to a fixed axis, and the conveyors also comprise an auxiliary wheel (62) that guides the straightening of the containers (15) after passage in the discharge zone.

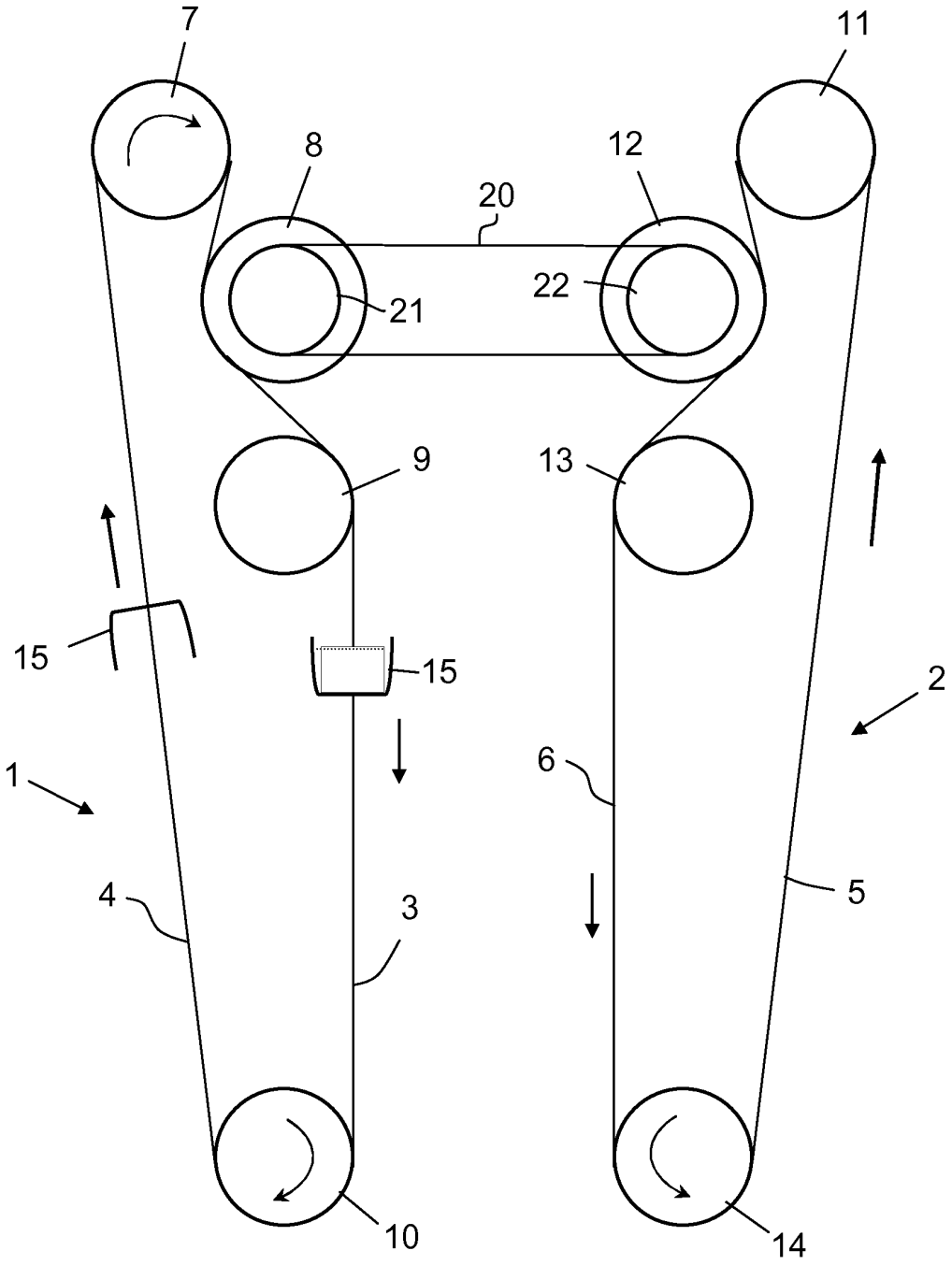

FIG. 1

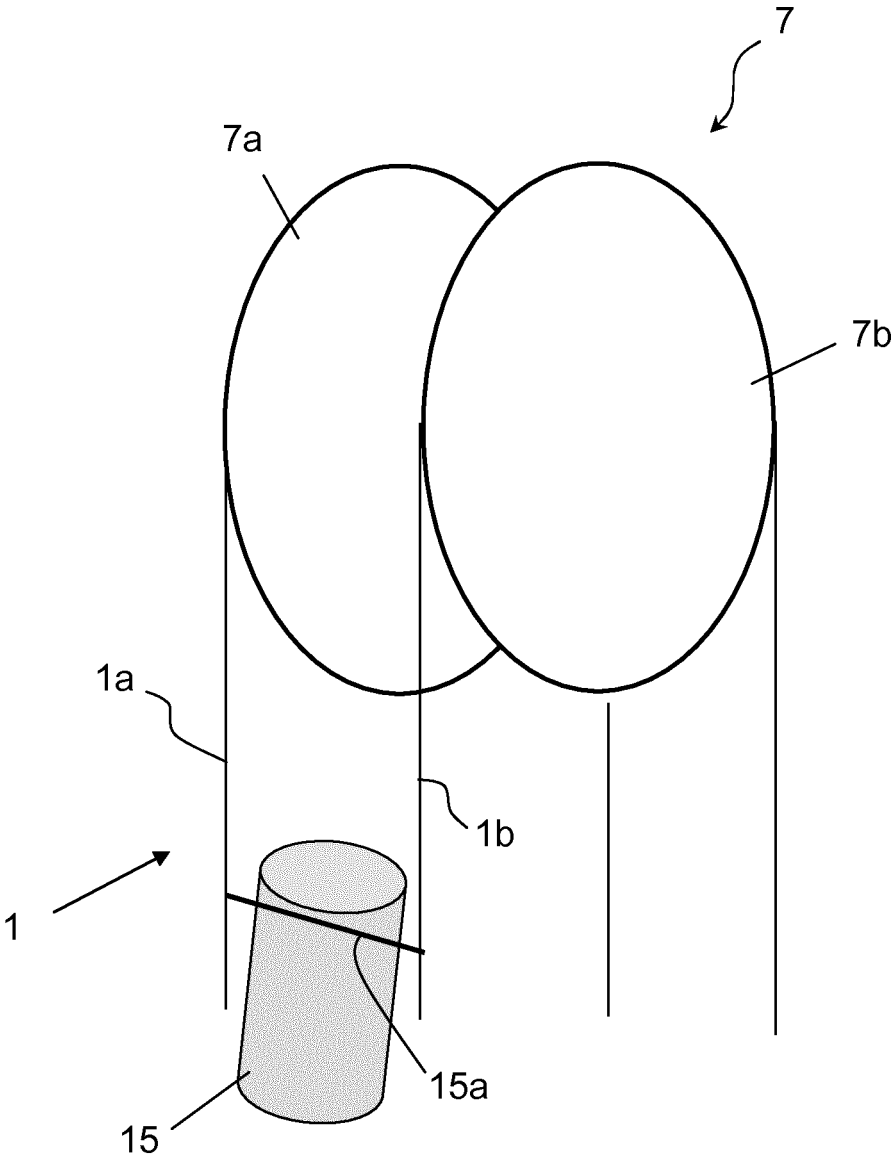

FIG. 2

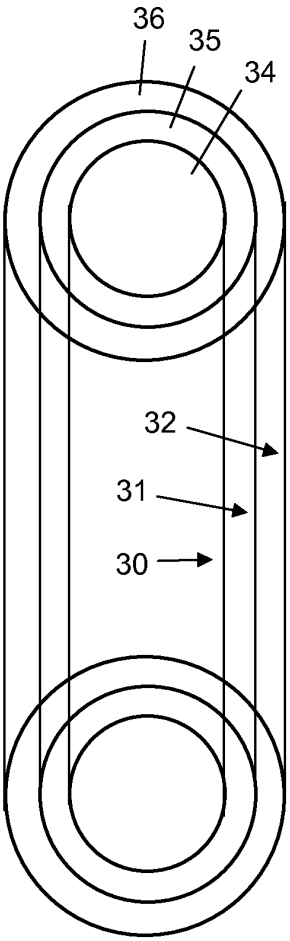

FIG. 3

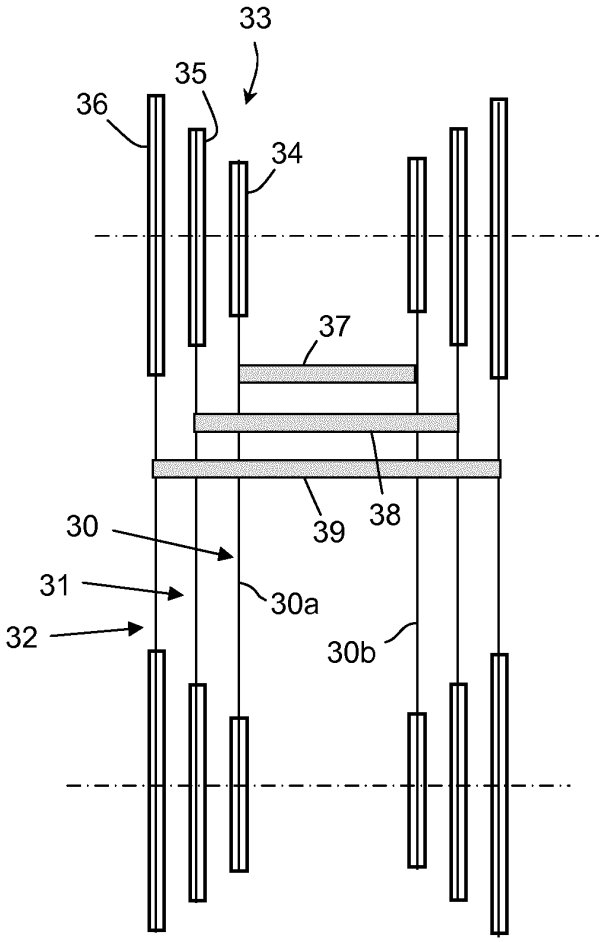

FIG. 4

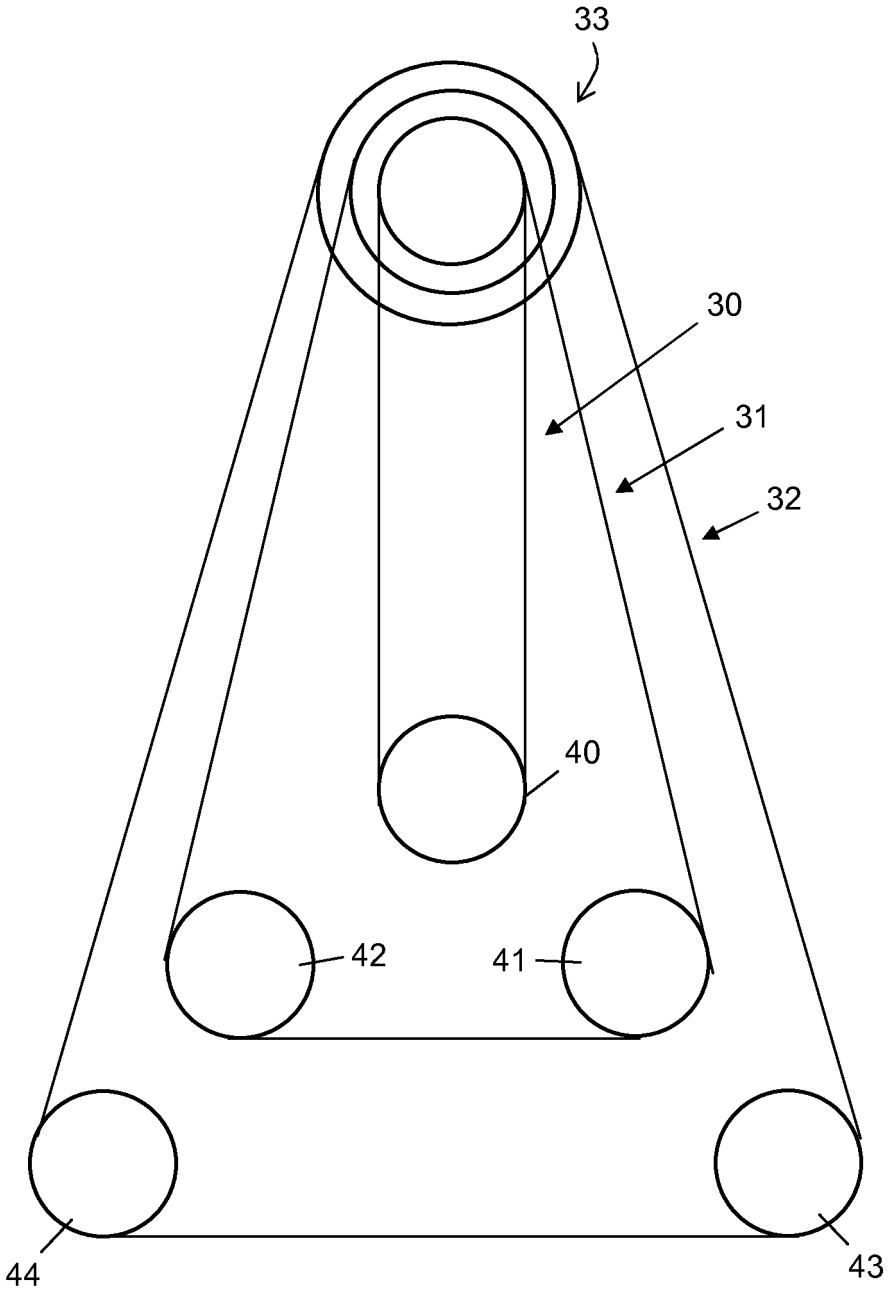

FIG. 5

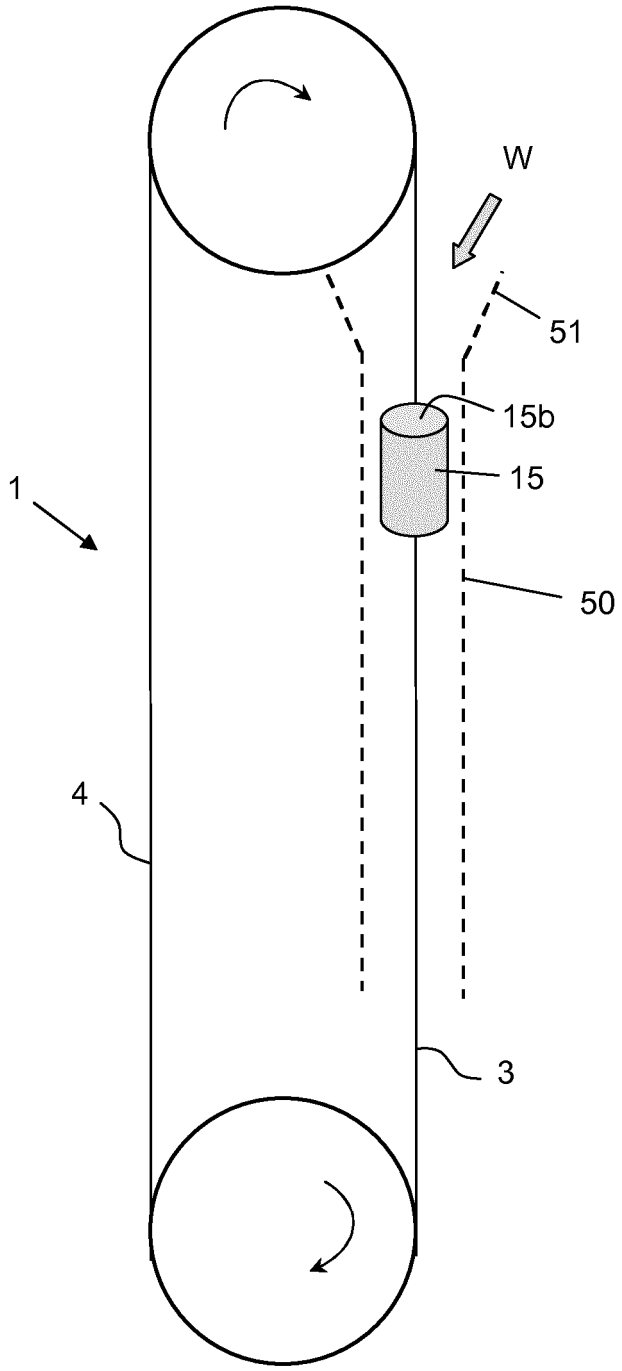

FIG. 6

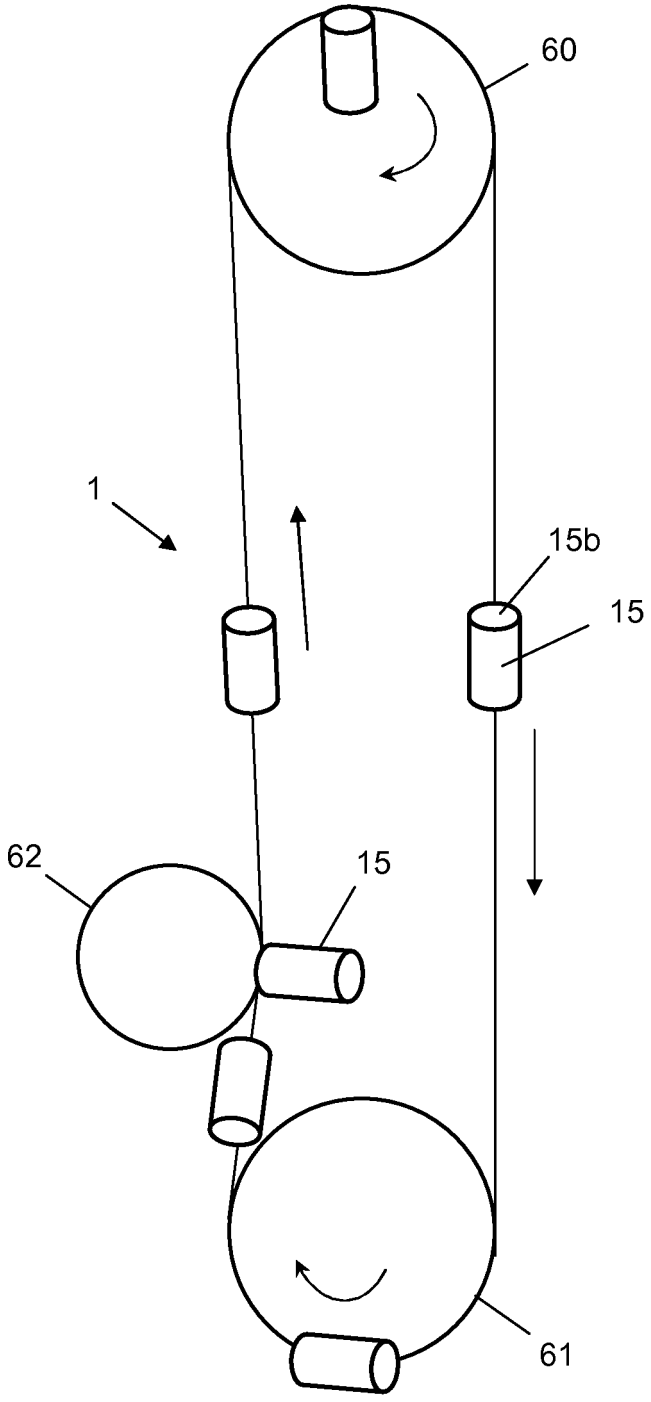

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 9191

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* page 3, line 19 - line 25 * * page 4, line 15 - line 17 * * page 5, line 1 - page 6, line 19 * * figures 1-6 *	7,8	
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Y	* paragraphs [0001], [0006], [0021], [0024], [0027], [0029] * * figures 1,3,5,6,7a *	7,8	
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TECHNICAL FIELDS SEARCHED (IPC)

F03B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 March 2013	Lux, Ralph

CATEGORY OF CITED DOCUMENTS

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14-03-2013

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82