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(54) **A two-drum winder and a method of operating a two-drum winder**

(57) The present invention relates to a two-drum winder for winding partial webs (10) for a fibrous web comprising at least two surface support elements (15, 20) to support a web roll (25) from below and a rider roll (30) which is arranged to support said web roll (25) at least for part of the forming time of the web roll above it. The rider roll (30) is provided with a vibration damper (40) arranged to attenuate rotational vibration of the rider roll such that the machine directional concurrent vibration of the web roll is attenuated via tangential force interaction between the rider roll (30) and the web roll (25), and that the vibration damper (40) comprises a mass element (42) which is rigidly coupled by a coupling system to the rider roll (30) to rotate along with the rider roll.

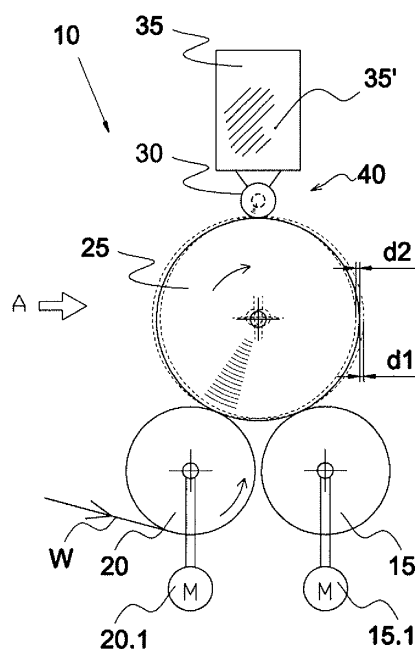


Fig. 1

Description

[0001] The present invention relates to a two-drum winder for winding partial webs according to the preamble of claim 1 for reducing machine directional vibrations in a partial web winder of a fibrous web. Invention relates also to method of operating a two-drum winder according to preamble of the other independent claim.

[0002] As is known in prior art, in a slitter-winder the machine roll is un-wound and the wide web is slit with the slitting part of the slitter-winder into a number of narrower partial webs that are rewound with a partial web winder to form customer rolls. When the customer rolls being simultaneously made from each partial web are ready, the slitter-winder is stopped and the partial web rolls are removed from the machine, i.e. the set change is done. Subsequent to this the process is continued as winding of a new set of rolls. These phases are repeated in sequences until the machine roll runs out of paper, whereby the machine roll is changed and the operation is started again as unwinding another machine roll. The partial web winder can be a two-drum type winder in which the partial web rolls are wound carried by winding drums, typically supported by a rider roll from above.

[0003] In winding, e.g. when winding a paper web with a slitter-winder, large vibrations occur in certain paper types at same roll rotation frequency ranges regardless of the running speed of the slitter. Usually there are about 1 to 3 vibration ranges, i.e. rotation speed ranges of the roll on which there is strong vibration, depending on the final diameter of the roll. This strong vibration causes winding reject, mechanical wear of the apparatuses, even loosening of the roll from the winding apparatus as well as decrease of winding capacity as the running speed has to be lowered during winding.

[0004] F1101283 discloses a method in which the running speed of the winder is controlled based on the rotation frequency of the roll so that as the rotation frequency of the roll approaches the vicinity of the vibration range, i.e. the roll rotation frequency range where there is a strong vibration, the running speed is quickly lowered so that the rotation speed of the roll decreases to below the lower frequency of the vibration range and subsequent to this the running speed is increased so that the rotation frequency of the roll remains constant until the original running speed of the winder is reached. Due to the change of the running speed this has an effect on the total capacity of the winder.

[0005] As the size of the partial web rolls increases during the winding, at least the rider roll is moved to compensate the growth of the diameter of the rolls. Thus at least the rider roll arrangement is movably supported by the body structure of the winding part. The consecutive longitudinal rolls are locked in their places as a line of rolls by means of a core locking device arranged at both ends. The support means contacting the roll (or rolls) to be wound are exposed to the dynamic load caused by the rotating roll. Especially in connection with two-drum

type of winders there occur dynamic loads causing vibration especially in the rider roll and the supporting rider roll beam, excited by the partial web rolls to be wound. It is also typical for the process that the diameter of the roll to be wound has an effect on the vibration of the rider roll. Thus the vibration conditions change as the winding proceeds.

[0006] The design aim of the rider roll of a slitter-winder is a stable construction able to withstand dynamic load. A generally used practical solution is one in which rider roll segments are suspended from a relatively rigid rider roll beam. The rider roll beam is moved along two or more guides attached to the body. Both the guides and the cylinders are located near the ends of the beam.

[0007] A particular form of vibration occurring in a two-drum winder is machine directional concurrent vibration of the rolls in the set. In a slitter-winder of the two-drum type, the whole set or single rolls can start to oscillate typically on a relatively low frequency (about 5 -15 Hz) in the machine direction on top of the winding drums. The phenomenon can limit the maximum speed usable in winding, thus decreasing capacity. In the worst case, the phenomenon can cause the off-throwing of the set.

[0008] Specification US 4180216 presents as a solution for the problem transferring the rider roll during winding along the surface of the web roll from its peak point as the web roll increases with the purpose of changing the spring constant of the web roll being completed. The specification also suggests using several rider rolls simultaneously to support the set. The adjustment of the position of the rider roll is described occurring pre-programmedly based on experience and the roll diameter of the set being completed, among others. With this type of an arrangement, it is in practice not possible to prevent the phenomenon sufficiently, because actual conditions in winding are always different from the ones of a previously compiled statistical model.

[0009] With certain fibrous-web types, the forming of partial web rolls can be achieved more advantageous if the rider roll is provided with a drive. Then, it is possible to apply moment/force, i.e. pull, to the surface of the web roll with the rider roll. Publication EP2108606 A2 describes a two-drum winder in which the rider roll unit comprises a drive. More particularly there is disclosed a two-drum winder which comprises at least two surface support elements of the roll arranged to support at least one roll being formed substantially below it and at least one loading device which is arranged to support said roll at least for part of the forming time of the roll substantially above it. The winder comprises also at least one drive so that the drive is arranged to apply tangential force to the roll being wound and a control arrangement which is arranged to control said at least one drive of the two-drum winder so that the drive provides the roll being wound with an effect diminishing the machine directional concurrent vibration of parallel rolls, which in this case is machine directional concurrent vibration of the rolls in the current set.. In order to operate in acceptable manner

the drive must be of considerable power and the system requires somewhat sophisticated controlling system.

[0010] Object of the invention is to provide such a two-drum winder by means of which the machine directional concurrent vibration of the rolls is at least minimized in a straightforward manner.

[0011] The objects of the invention are mainly achieved with a two-drum winder for winding partial webs according to claim 1 and method of operating a two-drum winder according to claim 11.

[0012] Unless more particularly defined, in this context the following definitions are valid. A two-drum winder refers to a web winder in which at least one roll being formed is supported below the roll with at least two surface support devices of the winder, such as a roll or a set of belts supported by rolls. The cross direction refers to the direction of the longitudinal axis of the surface support device, such as the roll, and the machine direction the direction perpendicular in relation to the cross direction and the vertical direction. A set refers to a set of partial web rolls being wound simultaneously on the winder. A roll refers to one or more rolls. Above and below refer to the upper side and under side of a horizontal plane passing via the centre of the roll. Belt means a belt, chain or any other endless power transmission loop. Term rigid means rigid in practical sense without an intention of having flexibility and/or rigid element does not influence on the dynamics of the rotation of the system.

[0013] Object of the invention are met by a two-drum winder for winding partial webs for a fibrous web comprising at least two surface support elements to support a web roll from below and a rider roll which is arranged to support said web roll at least for part of the forming time of the web roll above it. The rider roll is provided with a vibration damper arranged to attenuate rotational vibration of the rider roll such that the machine directional concurrent vibration of the web roll is attenuated via tangential force interaction between the rider roll and the web roll, and the vibration damper comprises a mass element which is rigidly coupled by a coupling system to the rider roll to rotate along with the rider roll.

[0014] Since the mass element is not in connection with, or in other words, is separated from the web rolls it size may be selected with greater freedom and based on the demands of its primary function.

[0015] Thus whenever the set of web rolls is subjected to the machine directional concurrent vibration excitation and would otherwise begin to resonate, the vibration damper reduces the machine directional vibrations of the web rolls. By selecting the mass moment of inertia properly it is also possible to affect the frequency of the resonance frequency.

[0016] According to an embodiment of the invention the coupling system comprises power transmission coupling between the rider roll and the mass element.

[0017] According to an embodiment of the invention the coupling system comprises power transmission coupling between the rider roll and the mass element which

is provided with on/off coupling so that the mass element may be engaged to or disengaged from the rider roll. So, as the rotation frequency of the rolls approaches the vicinity of the vibration range, i.e. the roll rotation frequency range where there is a strong vibration, the mass element may be coupled (or uncoupled in case it was previously coupled) to the rider roll. Due to effect of the mass element the resonance frequency may be change away from the rotation frequency of the rolls.

[0018] According to an embodiment of the invention the coupling system comprises power transmission loop coupling, having a first wheel connected to the rider roll and a second wheel connected to the mass element and a power transmission loop connecting the first and the second wheels.

[0019] According to an embodiment of the invention the first and the second wheel provide a gear ratio different from 1:1. Preferably the gear ratio is such that the mass element of the vibration damper is arranged to rotate at greater angular speed than the rider roll.

[0020] According to an embodiment of the invention the rider roll is supported by a beam extending over the length of the rider roll and comprising end walls at the opposite end thereof and the that the vibration damper is rotatably supported to the end walls.

[0021] According to an embodiment of the invention the rider roll is supported by a beam extending over the length of the rider roll and that the vibration damper is rotatably supported inside the beam.

[0022] According to an embodiment of the invention the vibration damper is arranged adjustable during operation of the two-drum winder.

[0023] According to an embodiment of the invention the coupling system comprises power transmission having a variably controllable transmission.

[0024] According to an embodiment of the invention the vibration damper comprises a friction damper coupled by a coupling system to the rider roll to rotate along with the rider roll.

[0025] According to an embodiment of the invention the vibration damper comprises a friction damper comprises a clutch member connected to the coupling system and a mass unit which is arranged rotatable such that the rotation is suppressed or allowed by a friction force in the contact between the mass unit and the clutch member.

[0026] A particular embodiment of the invention relates to initial acceleration phase of the winding during which the frequency of excitation of the machine directional concurrent vibration of the web roll is considerably high. The initial phase forms the bottom of the roll over which the layers are formed and therefore it is an important phase. In order to adequately suppress the concurrent vibration of the web roll the overall moment of inertia of the mass element of the vibration damper is at least 1,5 times the moment of inertia of the rider roll, but at least 5 m/s².

[0027] An object of the invention is also met by a meth-

od in which a two-drum winder is operated for winding partial webs for a fibrous web on at least two surface support elements to support a web roll from below and a rider roll which supports said web roll at least for part of the forming time of the web roll above it. The rider roll is provided with a vibration damper arranged to attenuate rotational vibration of the rider roll such that the machine directional concurrent vibration of the web roll is attenuated via tangential force interaction between the rider roll and the web roll, in which rotational vibration of the rider roll is damped by the vibration damper comprising a mass element which is rigidly coupled by a coupling system to the rider roll to rotate along with the rider roll.

[0028] According to an embodiment of the invention the method the mass moment of the inertia of the mass element is arranged to change the resonance frequency of the vibration.

[0029] According to another embodiment of the invention the winder is operated so that as the rotation frequency of the rolls approaches the vicinity of the vibration range the mass element is be coupled or uncoupled in case it was previously coupled, to the rider roll.

[0030] Due to effect of the mass element the resonance frequency may be change away from the rotation frequency of the rolls.

[0031] The other additional characteristic features of the invention will become apparent from the appended claims and the following description of the embodiments of figures.

[0032] In the following the invention and its operation are described with reference to the appended schematic drawings, in which

figure 1 illustrates an embodiment according to the invention in connection with a partial web winder of the two-drum type,

figure 2 illustrates a sectional view in the direction A of the figure 1, and

figure 3 illustrates an embodiment according to the invention in connection with a rider roll and rider roll beam,

figure 4 illustrates another embodiment according to the invention in connection with a rider roll and rider roll beam,

figure 5 illustrates still another embodiment according to the invention in connection with a rider roll and rider roll beam,

figure 6 illustrates still another embodiment according to the invention in connection with a rider roll and rider roll beam,

figure 7 illustrates still another embodiment according to the invention in connection with a rider roll and rider roll beam, and

figure 8 illustrates an example of operation of an embodiment of the invention.

[0033] Fig. 1 shows a two-drum winder 10 according to an embodiment of the invention. The two-drum winder

comprises a front winding drum 15 and a rear winding drum 20 as support rolls. The winding drums support from below a set of web rolls 25 being wound of partial webs W in the winder in a manner known as such. To support the roll 25 from the above there is also arranged a rider roll 30. The rider roll 30 is supported on a rider-roll beam 35. Here the terms above and below refer to the upside and underside of a horizontal plane passing via the centre of the roll. The rider roll may be a single roll extending from the first (front) side of the winder to the second (back) side thereof or it may be constructed of several interconnected roll segments. The interconnection means that the roll segments are rotatable connected with each other.

[0034] The winding drums 15, 20 of the two-drum winder 10 are provided with drives 15.1, 20.1 by means of which surface draw i.e. tangential force can be applied to the roll being formed. The rider roll 30 may also be provided with a drive, even if not shown here.

[0035] Fig. 1 schematically shows the machine directional concurrent vibration of parallel rolls which can be at least considerably minimised or even eliminated with the two-drum winder. In the machine directional concurrent vibration of parallel rolls 25, the whole set reference 25' in Fig. 2, moves back and forth in the machine direction from its stable position mainly by rotating alternately on the surface of the front and rear drum 15, 20 as is shown in exaggerated manner in Fig. 1. Individual back and forth motion of single rolls can be minimized by combining successive rolls 25 of the set 25' from their winding centers to each other e.g. by a sleeve 45 which sufficiently locks the centers to each other radially. This can be seen in Fig. 2, which shows section of the two-drum winder of Fig. 1 from direction A.

[0036] When examining the machine directional concurrent vibration of parallel rolls shown by Fig. 1 by way of an example in more detail, it is found that the web roll will rotate around the winding drum 15 clockwise, motion d1. Then, when rotating, each web roll is pressed with greater force against the rider roll 30. Equivalently, the set will rotate around the winding drum 20 counter clockwise, motion d2. Also from the effect of this motion d2, the web rolls are pressed with greater force against the rider roll 30. Then, nip force momentarily risen on the rider roll also increases friction force between the rider roll 30 and the surface of the web roll 25. The increase of friction force thus occurs at such points of time when via the rider roll 30 the effect of the vibration damper is to be conveyed to the web rolls of the set 25'. Hence, the arrangement according to the invention is very advantageous.

[0037] According to the invention the rider roll 30 is provided with a vibration damper 40, which comprises a mass element 42 providing additional mass to even the machine directional concurrent vibration of the web roll 25. The mass element 42 is rigidly coupled by a coupling system 44 to the rider roll 30. It is arranged to rotate along with the rider roll. Thus, in case the machine direc-

tional concurrent vibration of the web roll 25 tends to take place, the excitation of the vibration is transmitted into rotational oscillation of the rider roll 30. Due to the increased inertia of the rider roll - vibration damper system the rotational oscillation of the rider roll 30 is reduced and thus the machine directional concurrent vibration of the web roll 25 is minimized accordingly.

[0038] The machine directional concurrent vibration of parallel rolls affecting the whole set 25' can be minimised when the two-drum winder 10 comprises a vibration damper 40 arranged to the rider roll 30. The vibration damper 40 comprises a mass element 42 of suitable form. The mass element is coupled to the rider roll 30 by a coupling system 44 so that the mass element may rotate along with the rider roll by means of which the inertia of the system is increased. The mass element 42 coupled to the roll 30 via the coupling system is rigid so that the mass element follows the rotational vibration of the rider roll 30.

[0039] In the embodiment of figure 1 and 2 the coupling system is a bar or a shaft arranged at the common rotational axis of the roll and the mass element 42. The mass element is coupled to an end of the roll 30.

[0040] In figure 3 there is shown the rider roll and the beam according to an embodiment of the invention in which the vibration damper 40 is arranged above the beam 35 of the winder. This way it does not require or reserve space on the side of the winder, which is advantageous. The vibration damper 40 being located at a distance from the rider roll needs a coupling system which facilitates power transmission between the roll and the mass element 42. Thus the coupling system comprises a belt drive coupling 50 having a first belt wheel 51 connected to the rider roll 30 and a second belt wheel 52 connected to the mass element 42 and a belt 53 connecting the first and the second belt wheels. The belt is still or inelastic so that the mass element follows the rotation and rotational vibration of the rider roll 30.

[0041] In figure 4 there is shown an embodiment of the invention in which the vibration damper 40 is arranged inside the rider roll beam 35 of the winder. In figure 4 there is also shown how the coupling system 50 comprises a power transmission coupling between the rider roll and the mass element. Particularly in the figure 4 the power transmission coupling is a belt drive coupling 50. The belt drive coupling comprising a first belt wheel 51 connected to the rider roll 30 and a second belt wheel 52 connected to the mass element 42 and a belt 53 connecting the first and the second belt wheels. The mass element 42 is supported to an end wall 35' of the beam 35. As can be seen the mass element is in the figure 4 a cylindrical object. What is noteworthy is that the first belt wheel and the second belt wheel are of different effective diameter, in other words the first and the second wheel provide a gear ratio different from 1:1. It is particularly advantageous when the mass element is arranged to rotate at higher speed than the rider roll. Increasing the rotational speed of the mass element the kinetic energy

may be increased without increasing the moment of inertia of the mass element of the vibration damper.

[0042] The gear ratio should in practice be as big as possible given that the flexibility of the transmission, e.g. a belt will not disturb or dominate the operation. The mass moment of inertia increases with square of the gear ratio.

[0043] Thus according to an embodiment of the invention the rotational speed of the mass element is arranged to increase in response to the web roll diameter.

[0044] As an example, if the mass has a certain weight (or moment of inertia), its effect to the kinetic energy of the rotating mass element may be increased by square by increasing its rotational speed. Thus the rider roll may prevent more efficiently the machine directional concurrent vibration of the web roll via tangential force interaction between the rider roll 30 and set 25' of the web rolls 25.

[0045] Even if not shown, the power transmission coupling may be realized also by different kinds of gear or surface drive devices. The weight of the mass element may be of the same magnitude as the rider roll.

[0046] In figure 5 there is shown an embodiment of the invention in which the vibration damper 40 is also arranged inside the rider roll beam 35 of the winder. The coupling system 44 comprises a belt drive coupling 50 as the power transmission system. The belt drive coupling comprises a first belt wheel 51 connected to the rider roll 30. The first belt wheel is nonadjustable i.e. its diameter is fixed. The second belt wheel 52 connected to drive the mass element 42 is adjustable such that its effective diameter may be changed during the operation and thus the transmission ratio of the belt drive coupling may be changed. The second wheel may comprise means for changing the distance between the opposing inner surfaces of the wheel which, given that the belt has fixed width, changes the radial contact distance of the belt. A belt 53 is connecting the first and the second belt wheels.

[0047] In figure 6 there is shown an embodiment of the invention in which the mass element of the vibration damper comprises a friction damper 60. The friction damper may be attached in connection with a separate mass element 42, as is the case in figure 6. The friction damper may also be constructed to be in integral part of the mass element or it may be the mass element by selecting its the weight properly.

[0048] The friction damper 60 is shown enlarged as its encircled portion in the figure. The friction damper 60 comprises a shaft 62 which is coupled to the mass element or to the second belt wheel 52 or the coupling system 44 (not shown). Thus the shaft 62 rotates along with the coupling system and thus also with the rider roll 30. The friction damper comprises a clutch member 64 secured to the shaft 62 so that they rotate as a unit. The purpose and operation of the clutch member will be explained later. The friction damper 60 comprises further a mass unit 66 which is supported rotatably in respect to the shaft. In the figure 7 the mass unit 66 is supported by bearings 68 to the clutch member 64. Alternatively the mass

unit 66 may be supported directly by the shaft 62.

[0049] The mass unit 66 is constantly pressed against the clutch member 64 so that friction force in the contact between the mass unit 66 and the clutch member 64 maintains the otherwise freely rotatable mass unit 66 fixed with the clutch member.

[0050] In the embodiment of figure 6 the mass unit 66 comprises two disk-like parts 66.1, 66.2 and the clutch member 64 comprises a portion 70 radially between the two disk-like parts 66.1, 66.2. The disk-like parts are urged towards each other by spring elements 72 pressed by pins 74 or a like so that the clutch member 64 is constantly pressed between them. The press contact is made via friction pads 74. The mass unit 66 and the clutch member 63 are immovably coupled with each other until the clutch member accelerates so strongly that the force exceeds the static friction. On other words, it is only after the torque between the mass unit 66 and the clutch member 64 brings about a force to the joint between the mass unit 66 and the clutch member 64 exceeding the static friction of the joint, the mass unit 66 will rotated at lower speed than the clutch member 64 and dynamic friction of the joint dissipates as heat to the surroundings. This of solution is shown in generally in publication W. T. Thomson 1972, Theory of Vibration. New Jersey: Prentice-Hall.

[0051] In case the friction damper is constructed to be the mass element the total weight of the friction damper is allocated between the mass unit 66 and the clutch member 64 to the case. An example of such construction is shown in figure 7 using the same reference number for corresponding elements.

[0052] In the figure 8 there is shown the effect of the invention as an example. The graph 70 depicts the case without the vibration damper, the graph 72 depicts the case with 4 times increased mass moment of inertia of the rider rolls, the graph 74 depicts the case with 8 times increased mass moment of inertia of the rider rolls and the graph 76 depicts the case with 12 times increased mass moment of inertia of the rider rolls. The characteristics of the winder were: width of the set 7 m, diameter of the web rolls 900 mm, the mass eccentricity of the web rolls 0.01 mm, diameter of the winding drums 800 mm, diameter of the rider rolls 200 mm. From the figure 8 it can be seen that the increase of the mass moment of inertia has two effects: the height of the resonance spike decreases with the mass moment of inertia and secondly the natural frequency decrease with the mass moment of inertia. The former feature enables avoiding running at the resonance by altering the mass moment of inertia according to the rotation frequency of the web rolls.

[0053] It should be noted that only a few of the most preferable embodiments are disclosed above. Thus, it is obvious that the invention is not limited to the above-mentioned embodiments but it can be applied in many ways within the scope defined by the appended claims. The features disclosed in connection with various embodiments can also be used in connection with other em-

bodiments within the inventive scope and/or different embodiments can be combined from the disclosed features, should it be desired and should it be technically feasible.

Claims

1. A two-drum winder for winding partial webs (10) for a fibrous web comprising at least two surface support elements (15, 20) to support a web roll (25) from below and a rider roll (30) which is arranged to support said web roll (25) at least for part of the forming time of the web roll above it, **characterized in that** the rider roll (30) is provided with a vibration damper (40) arranged to attenuate rotational vibration of the rider roll such that the machine directional concurrent vibration of the web roll is attenuated via tangential force interaction between the rider roll (30) and the web roll (25), and that the vibration damper (40) comprises a mass element (42) which is rigidly coupled by a coupling system to the rider roll (30) to rotate along with the rider roll.

2. A two-drum winder for winding partial webs (10) according to claim 1, **characterized in that** coupling system (44) comprises power transmission coupling between the rider roll (30) and the mass element (42).

3. A two-drum winder for winding partial webs (10) according to claim 2, **characterized in that** coupling system (44) is provided with on/off coupling.

3. A two-drum winder for winding partial webs (10) according to claim 2, **characterized in that** coupling system comprises power transmission loop coupling, having a first wheel connected to the rider roll and a second wheel connected to the mass element and a power transmission loop connecting the first and the second wheels.

4. A two-drum winder for winding partial webs (10) according to claim 2, **characterized in that** the first and the second wheel provide a gear ratio different from 1:1.

5. A two-drum winder for winding partial webs (10) according to claim 1, **characterized in that** the rider roll (30) is supported by a beam (35) extending over the length of the rider roll (30) and comprising end walls (35') at the opposite end thereof and that the vibration damper is rotatably supported to the end walls.

6. A two-drum winder for winding partial webs (10) according to claim 1, **characterized in that** the rider roll (30) is supported by a beam (35) extending over the length of the rider roll (30) and that the vibration

damper (40) is rotatably supported inside the beam (35).

7. A two-drum winder for winding partial webs (10) according to claim 2, **characterized in that** the vibration damper is arranged adjustable during operation of the two-drum winder (10). 5

8. A two-drum winder for winding partial webs (10) according to claim 2 or 6, **characterized in that** coupling system comprises power transmission having a variably controllable transmission. 10

9. A two-drum winder for winding partial webs (10) according to claim 1, **characterized in that** vibration damper comprises a friction damper coupled by a coupling system to the rider roll (30) to rotate along with the rider roll. 15

10. A two-drum winder for winding partial webs (10) according to claim 9, **characterized in that** vibration damper comprises a friction damper comprises a clutch member (64) connected to the coupling system and a mass unit (66) which is arranged rotatable such that the rotation is suppressed or allowed by a friction force in the contact between the mass unit (66) and the clutch member (64). 20 25

11. Method of operating a two-drum winder in which partial webs (10) for a fibrous web are wound on at least two surface support elements (15,20) supporting a web roll (25) from below and in which a rider roll (30) supports said web roll at least for part of the forming time of the web roll above it, **characterized in that** the rider roll (30) is provided with a vibration damper (40) arranged to attenuate rotational vibration of the rider roll such that the machine directional concurrent vibration of the web roll (25) is attenuated via tangential force interaction between the rider roll and the web roll, in which rotational vibration of the rider roll is damped by the vibration damper (40) comprising a mass element (42) which is rigidly coupled by a coupling system to the rider roll to rotate along with the rider roll. 30 35 40

12. Method according to claim 11, **characterized in that** in the method the mass moment of the inertia of the mass element (42) is arranged to change the resonance frequency of the vibration. 45

13. Method according to claim 12, **characterized in that** the winder is operated so that as the rotation frequency of the rolls approaches the vicinity of the vibration range the mass element is be coupled or uncoupled in case it was previously coupled, to the rider roll. 50 55

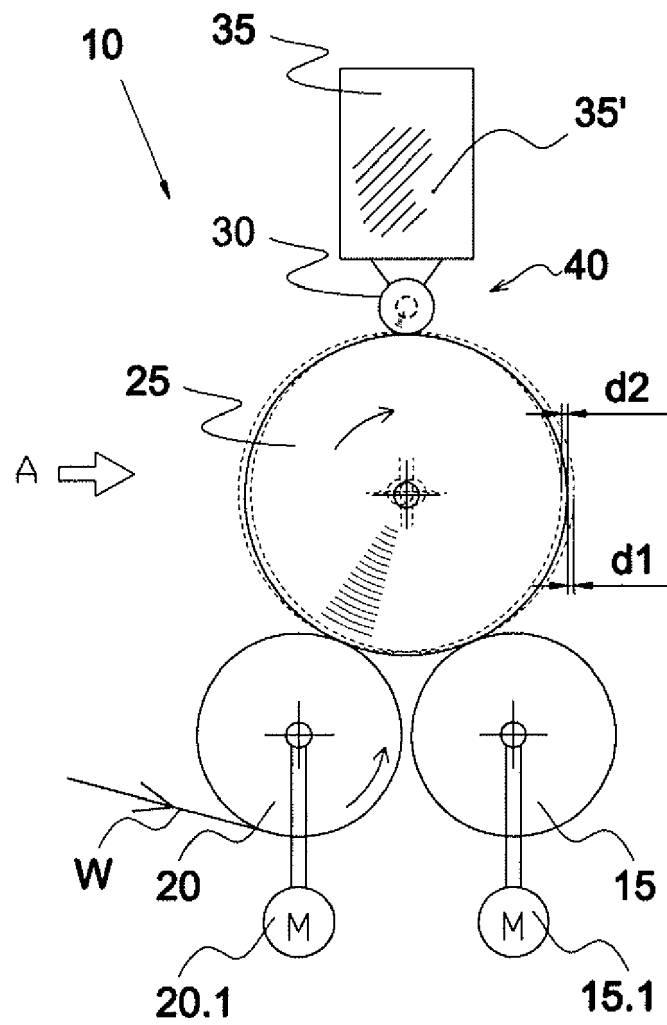
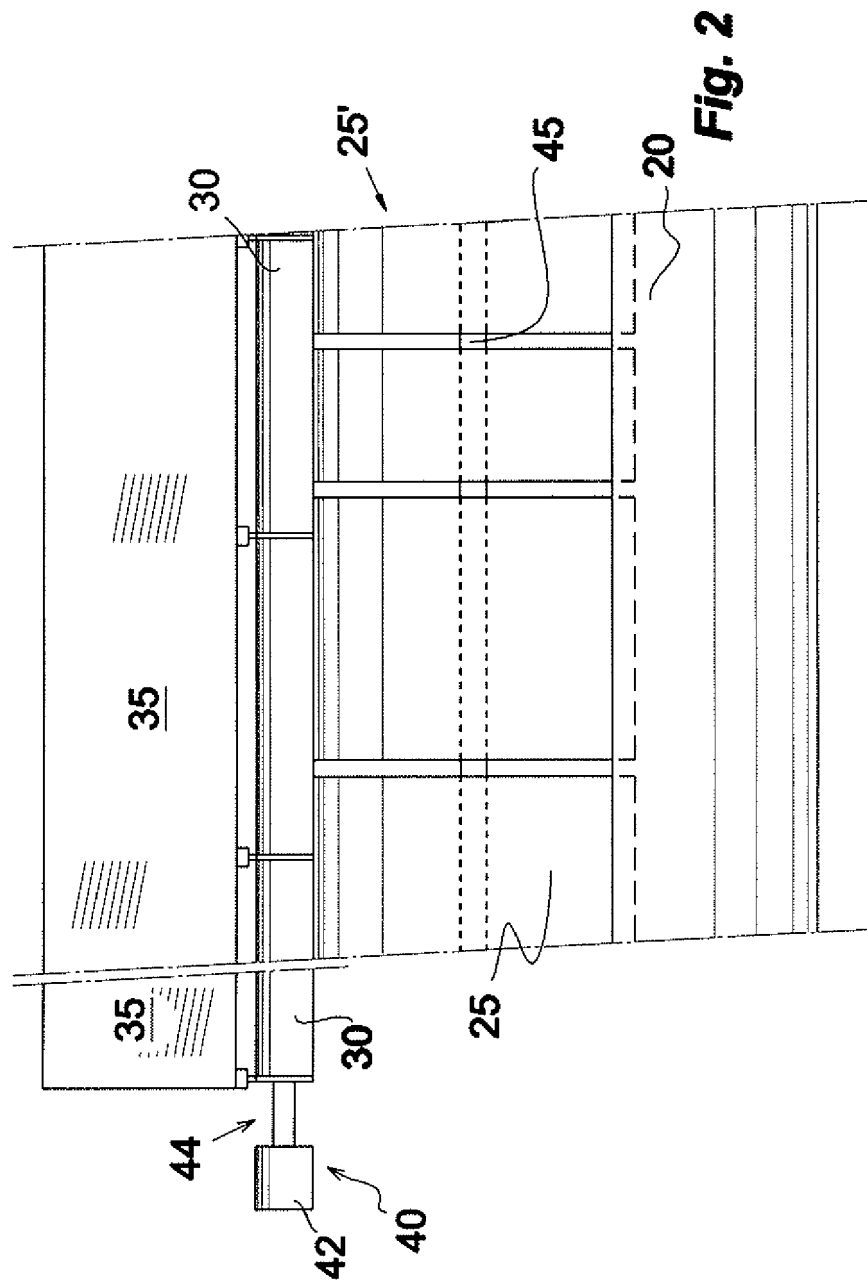


Fig. 1



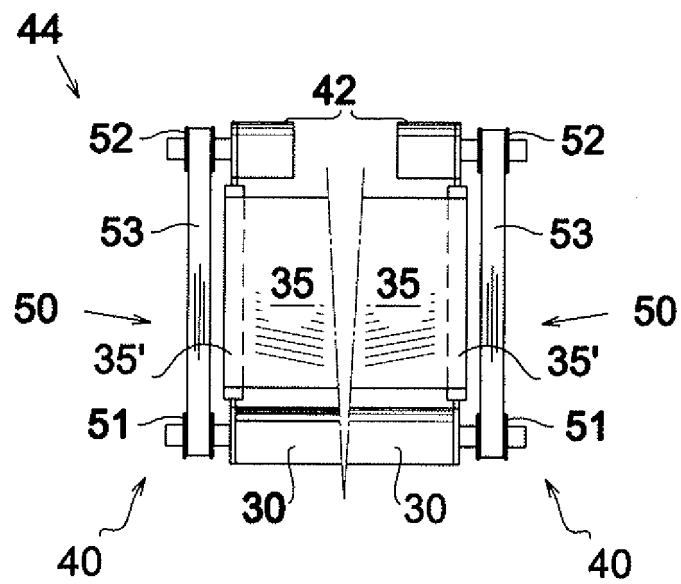


Fig. 3

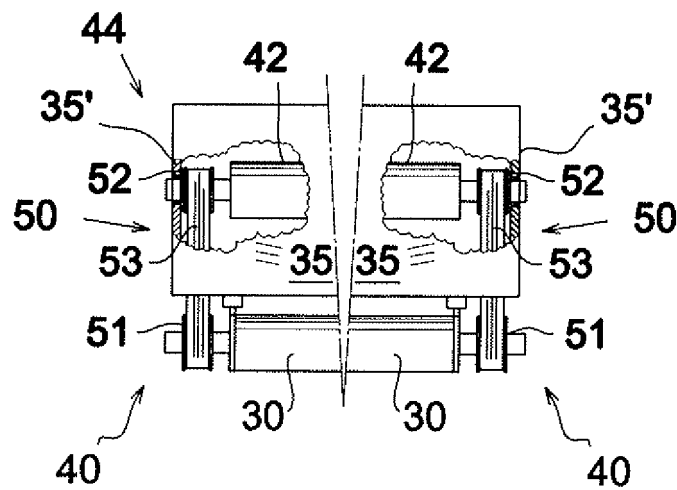


Fig. 4

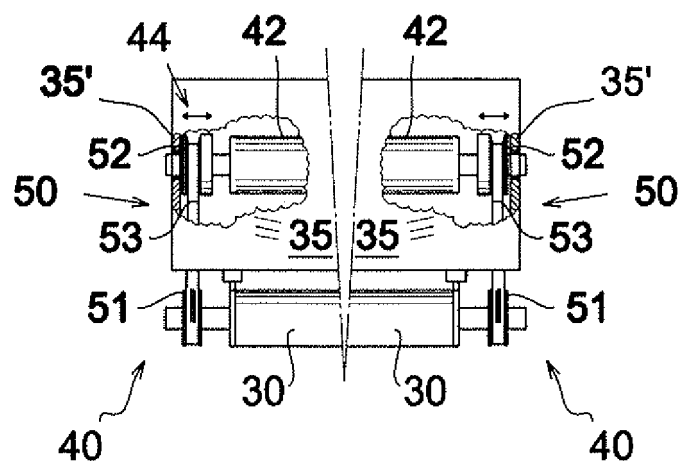
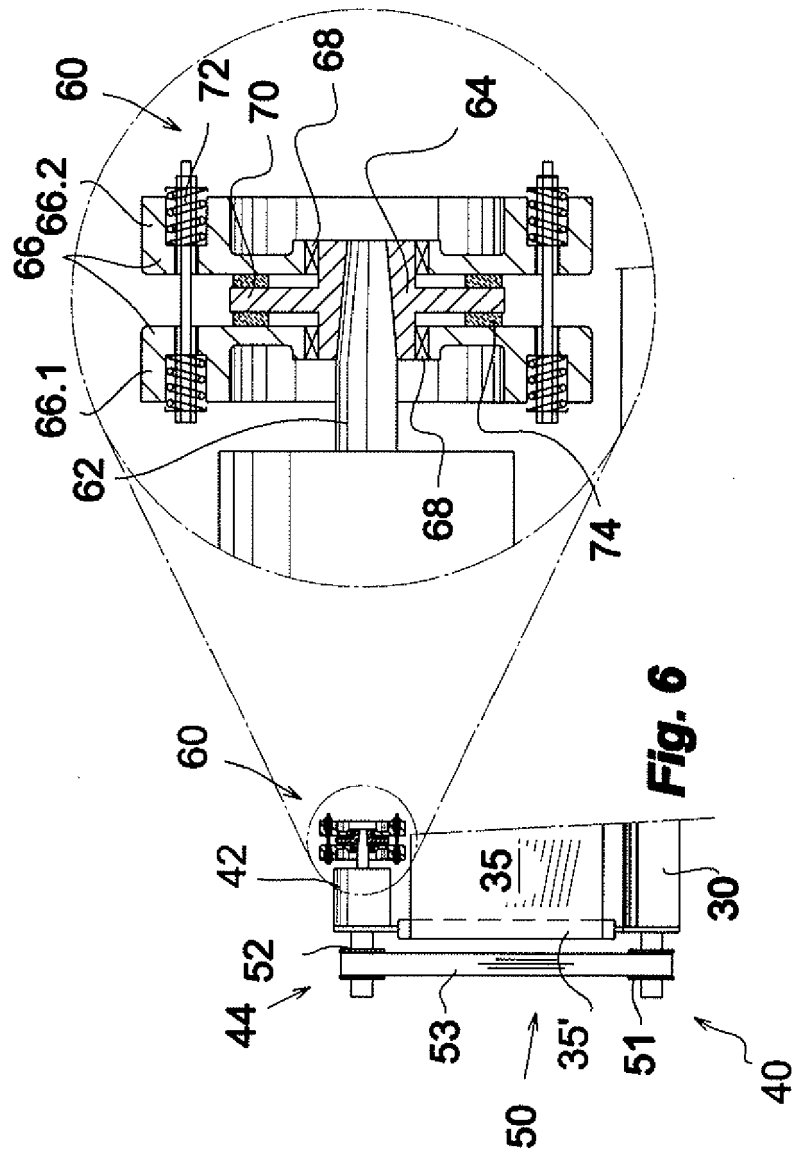


Fig. 5



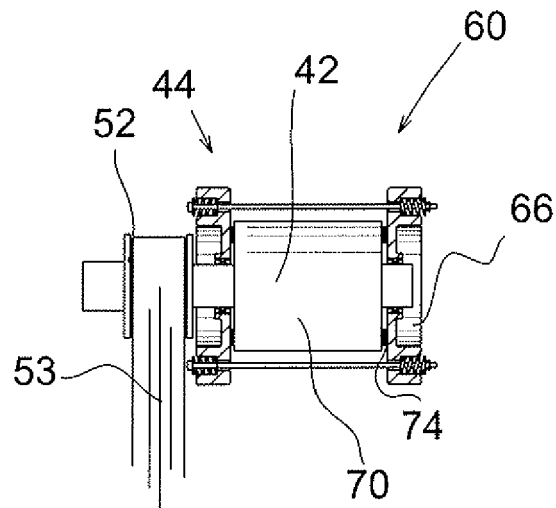


Fig. 7

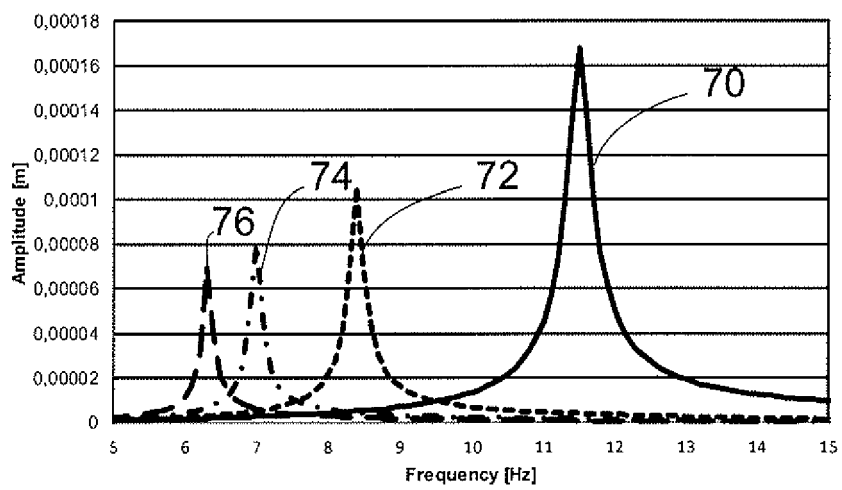


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 13 17 1377

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search The Hague		Date of completion of the search 15 November 2013	Examiner Piekarski, Adam
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