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(54) **Slack preventing device for wire rod wound around spool, and slack preventing method therefore**

Lockerungsvermeidungsvorrichtung für um eine Spule gewickelten Walzdraht, und Lockerungsvermeidungsverfahren dafür

Dispositif de prévention de mou pour tige de fil métallique enroulé autour d'une bobine et procédé de prévention de mou

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Description

[0001] The present invention relates to a device which is installed parallel to a wire rod feeding machine feeding a wire rod by rotating a spool around which the wire rod is wound, and prevents a slack of the wire rod wound around the spool, and a method of preventing the slack.

[0002] Conventionally, as a structure for supplying a wire rod to a winding machine or the like, there has been known a wire rod feeding machine which feeds the wire rod by rotating a spool around which the wire rod is wound, and the wire rod feeding machine is shown in Fig. 5. A wire rod feeding machine 1 shown in Fig. 5 supports a spool 2 while setting a rotating axis 2a horizontally, and is provided with a motor 3 which rotates the spool 2. A wire rod 4 can be fed from the spool 2 by rotating the spool 2 by means of the motor 3, and the wire rod 4 fed out of the spool 2 is wound around a pulley 5b which is pivotally supported to a leading end of an oscillating bar 5a corresponding to a tension applying device 5 so as to be converted, and passes through a wire guide 6 so as to be guided to a winding core 7 which winds the wire rod 4. The oscillating bar 5a is provided with a spring 5c corresponding to a tension applying mechanism which energizes in a direction of moving the pulley 5b away from the winding core 7, and a predetermined tensile force is applied to the wire rod 4 which is converted in the pulley 5b, on the basis of an energizing force of the spring 5c. Further, the motor 3 is structured such that it rotates the spool 2 so as to feed the wire rod 4 at a time when the oscillating bar 5a is tilted to the winding core 7 side as shown by a one-dot chain line, and stops the rotation of the spool 2 so as to stop the feeding of the wire rod 4 at a time when the oscillating bar 5a is tilted to a direction of moving away from the winding core 7 as shown by a two-dot chain line on the basis of the feeding of the wire rod 4.

[0003] Patent Document 1: Japanese Patent Application Laid-open No. H3-159541 (Fig. 1 and Fig. 4)

[0004] However, since the spring 5c energizing in the direction of moving the pulley 5b away from the winding core 7 applies a force energizing in a direction of moving away from the winding core 7 to the wire rod 4, the spring 5c confers a resistance against a motor which rotates the winding core 7 and is not illustrated. Accordingly, it is preferable that the force energizing the wire rod 4 in the direction of moving away from the winding core 7 is as weak as possible, as long as the wire rod 4 is wound around the winding core 7 without slacking. However, since the spring 5c energizing in the direction of moving the pulley 5b away from the winding core 7 also pulls in a direction of drawing the wire rod 4 out of the spool 2, there is generated a problem that if the force of the spring 5c is weakened, the wire rod 4 is not drawn even by rotating the spool 2, and the wire rod 4 wound around the spool 2 is loosened in the spool 2. Further, if the wire rod 4 is loosened in the spool 2, it becomes hard to detect a remaining amount of the wire rod 4 in the spool 2, or the detection becomes unstable.

[0005] In this case, in order to prevent the matter that the wire rod 4 is loosened in the spool 2, it is possible to think the structure in which the wire rod 4 is drawn out of the spool 2 on the basis of its own weight of the wire rod 4 between the spool 2 and the winding core 7 by largely expanding a distance between the spool 2 and the winding core 7. However, if the matter that the wire rod 4 is loosened in the spool 2 is avoided by moving the spool 2 widely away from the winding core 7, there is a problem that an installation area for equipment such as the wire rod feeding machine 1 rotating the spool 2 and the winding machine rotating the winding core 7 is significantly wider.

[0006] Further, for example, if a cross section of the winding core 7 around which the wire rod 4 is wound is formed as a flat shape such as a rectangular shape, a winding speed of the wire rod 4 wound around the winding core 7 is not constant, and in the case that the cross section of the winding core 7 is rectangular and a longer side thereof is significantly longer in comparison with a shorter side, the speed of the wire rod 4 significantly changes, and a movement and a stop thereof are alternately repeated. Accordingly, the feeding and the stop of the wire rod 4 are alternately repeated in the wire rod feeding machine 1, and the winding speed in the winding machine substantially depends on the feeding speed of the wire rod 4 in the wire rod feeding machine 1. In the case that the comparatively large spool 2 is rotated, it becomes hard to rapidly feed the wire rod due to its inertia, and there is a problem that it becomes hard to increase the winding speed.

[0007] In order to dissolve this point, there can be thought the matter that comparatively a lot of wire rods 4 are set to a previously fed state, however, if the wire rod 4 is maintained in the fed state, there is generated a problem that the fed wire rod 4 is returned to the spool 2 side on the basis of its elasticity, and the wire rod 4 wound around the spool 2 is loosened in the spool 2. Therefore, in the wire rod feeding machine 1 which feeds the wire rod 4 by rotating the spool 2 around which the wire rod 4 is wound, it is convenient to prevent a slack of the wire rod 4 in the spool 2 by securely feeding the fed wire rod 4 without returning to the spool 2 side.

[0008] JP H02 137343 A describes a wire feed apparatus. A wire sent out from feed rollers is fed to the supply side through guides. During this process, the wire is bent by its own weight between the guides; a turn part is formed. When the turn part is reduced gradually and the wire approaches the metal rod, a sensor is turned on, thereby detecting a state of tension; a motor is turned by the detection signal and the wire is sent out again.

[0009] JP S60 6794 U describes another wire feed apparatus.

[0010] An object of the present invention is to provide a slack preventing device for a wire rod wound around a spool, which can prevent a slack of the wire rod in the spool by preventing the wire rod fed by a rotation of the

spool from returning to the spool, and a slack preventing method of the same.

[0011] The addresses Problems are solved by a slack preventing system according to claim 1 as well as by a slack preventing method according to claim 4.

[0012] The present invention relates to a wire rod slack preventing device which is installed parallel to a wire rod feeding machine feeding a wire rod by rotating a spool around which the wire rod is wound.

[0013] A characteristic structure thereof exists in provision of a reverse rotation roller having a rotating axis which is parallel to a rotating axis of a spool and rotating in a reverse direction to a rotating direction of the spool while being in contact with the spool, a forward rotation roller having a rotating axis which is parallel to the rotating axis of the reverse rotation roller and rotating in the same direction as the spool while being in contact with the reverse rotation roller, and a pinching roller having a rotating axis which is parallel to the rotating axis of the forward rotation roller and pinching a wire rod which is fed out of the spool together with the forward rotation roller.

[0014] It is preferable that the slack preventing device for the wire rod wound around the spool is further provided with a pair of support posts which are erected so as to pinch the spool, in which the rotating axis is set horizontally, from both sides in a direction of the rotating axis thereof, a transverse support bar which is provided in such a manner as to be bridged between the pair of support posts, and a pair of pivotally supporting bodies which are provided in the transverse support bar to be spaced apart from each other at a wider distance than a width, in the direction of the rotating axis, of the spool, and both end portions of the reverse rotation roller, the forward rotation roller and the pinching roller are rotatably supported to the pair of pivotally supporting bodies.

[0015] The wire rod feeding machine is preferably structured such that it is provided with a deflection sensor which detects a deflection of the fed wire rod in a non-contact manner, rotates the spool in the case that the deflection sensor detects a reduction of the slack or the fed wire rod, and stops the rotation of the spool in the case that the deflection sensor detects a predetermined amount of slack of the fed wire rod.

[0016] Further, the other aspect of the present invention relates to a slack preventing method for a wire rod in a wire rod feeding machine which feeds the wire rod by rotating a spool around which the wire rod is wound.

[0017] A characteristic point thereof exists in rotating a reverse rotation roller having a rotating axis which is parallel to a rotating axis of a spool, in a reverse direction to a rotating direction of the spool while being in contact with the spool, rotating a forward rotation roller having a rotating axis which is parallel to the rotating axis of the reverse rotation roller, in the same direction as the spool while being in contact with the reverse rotation roller, pinching a wire rod which is fed out of the spool by a pinching roller having a rotating axis which is parallel to the rotating axis of the forward rotation roller and the forward rotation roller, and drawing the wire rod which is fed out due to the rotation of the spool, while pinching the wire rod by the forward rotation roller which rotates with the rotation of the spool, together with the pinching roller.

[0018] In the wire rod slack preventing device and the wire rod slack preventing method according to the present invention, since the forward rotation roller rotating together with the rotation of the spool pinches and draws the wire rod which is fed out due to the rotation of the spool together with the pinching roller, it is possible to prevent the wire rod which is fed out by rotating the spool from returning to the spool, whereby the fed wire rod is not loosened in the spool, and it is possible to prevent the slack of the wire rod in the spool. Further, since the forward rotation roller rotates together with the rotation of the spool, it is possible to make the other power than a power for rotating the spool unnecessary.

Fig. 1 is a perspective view showing a slack preventing device for a wire rod in an embodiment according to the present invention;

Fig. 2 is a side elevational view of the slack preventing device for the wire rod;

Fig. 3 is a front elevational view of the slack preventing device for the wire rod;

Fig. 4 is a side elevational view showing a state in which a forward rotation roller draws the wire rod together with a pinching roller; and

Fig. 5 is a side elevational view showing a conventional wire rod feeding machine.

[0019] Next, a description will be given in detail of a mode for carrying out the present invention on the basis of the accompanying drawings.

[0020] A wire rod slack preventing device 20 in the present invention is shown in Fig. 1 to Fig. 3. The wire rod slack preventing device 20 is installed parallel to a wire rod feeding machine 10 which feeds out a wire rod 11 by rotating a spool 12 around which the wire rod 11 is wound. The wire rod 11 in this embodiment is shown as a case that a so-called flat square wire having a rectangular cross sectional shape is employed, however, the wire rod 11 may be constructed by a so-called square wire having a square cross section, or may be constructed by a so-called round wire having a circular cross section. Further, the wire rod 11 may be constructed by a long object, for example, a film. The spool 12 around which the wire rod 11 is wound has a columnar body portion 12a (Fig. 2 and Fig. 4) in which the wire rod 11 is actually wound around an outer periphery, and discoid flange portions 12b which are formed coaxially in both ends in an axial direction of the body portion 12a.

[0021] The wire rod feeding machine 10 rotating the spool 12 is provided with a pair of bases 13 which are installed in such a manner as to pinch the flange portions 12b in both sides of the spool 12 in which a rotating axis is set horizontally, from an outer side while being spaced,

a pair of support rollers 14 which are bridged between the pair of bases 13 and on which the spool 12 is mounted, and a motor 16 which rotates any one or both of the pair of support rollers 14. In the drawing, there is shown a case that the motor 16 rotating one of the pair of support rollers 14 is provided. Further, the motor 16 is structured such that it can rotate the spool 12 which is mounted on the pair of support rollers 14, by rotating one or both of the pair of support rollers 14.

[0022] As shown in Fig. 1 and Fig. 2, the wire rod feeding machine 10 is provided with a deflection sensor 17 which detects a deflection of the wire rod 11 fed out of the spool 12 in a non-contact manner. The deflection sensor 17 is provided with a pair of support posts 17a which are erected in both sides in a width direction of the fed wire rod 11 while being spaced at a predetermined distance in such a manner as to pinch the wire rod 11. The pair of support posts 17a are provided in their lower portions with lower sensors 17b which detect in a non-contact manner a case that the bending wire rod 11 comes down on the basis of its own weight, and are provided in their upper portions with upper sensors 17c which detect in a non-contact manner a case that the bending wire rod 11 is taken back so as to rise. Further, in the case that the upper sensors 17c in the deflection sensor 17 detect a reduction of the deflection of the fed wire rod 11, the spool 12 is rotated by driving the motor 16, and in the case that the lower sensor 17b in the deflection sensor 17 detects a predetermined amount of deflection of the fed wire rod 11, the rotation of the spool 12 is stopped by stopping the driving of the motor 16.

[0023] The wire rod slack preventing device 20 according to the present invention which is installed parallel to the wire rod feeding machine 10 mentioned above is provided with a pair of support posts 21 which are provided in outer sides of the pair of bases 13 in a standing manner so as to pinch the spool 12 which is mounted to the pair of support rollers 14 while setting a rotating axis horizontally from both sides in a direction of the rotating axis. Each of the pair of support posts 21 is provided with a movable member 22 which can be moved up and down so as to be fixed at an optional position, and a transverse support bar 23 is bridged between the movable members 22. In other words, the transverse support bar 23 is horizontally bridged between the pair of support posts 21 via the movable members 22 in such a manner as to be parallel to the rotating axis of the spool 12.

[0024] As shown in Fig. 3, the transverse support bar 23 is provided with a pair of pivotally supporting bodies 24 while being spaced at a wider distance than a width in a direction of the rotating axis of the spool 12. Each of the pair of pivotally supporting bodies 24 is formed as a plate-like shape which is longer in a vertical direction, and an upper portion thereof is attached to the transverse support bar 23. Further, both end portions of a reverse rotation roller 26, a forward rotation roller 27 and a pinching roller 28 are rotatably supported to the pair of pivotally supporting bodies 24.

[0025] As shown in Fig. 1 to Fig. 4, the reverse rotation roller 26 is provided in the lowermost ends of the pair of pivotally supporting bodies 24. The reverse rotation roller 26 is provided in parallel to the rotating axis of the spool 12. Further, the reverse rotation roller 26 is provided in such a manner as to come into contact with the spool 12. The reverse rotation roller 26 in the embodiment is shown as a case that an outer periphery thereof is in contact with the outer peripheries of the flange portions 12b in the spool 12, as shown in Fig. 2 or Fig. 4. Since the outer periphery comes into contact with the spool 12 as mentioned above, the reverse rotation roller 26 is structured such that it rotates in a reverse direction to the rotating direction due to the rotation of the spool 12.

[0026] The forward rotation roller 27 has a rotating axis which is parallel to the rotating axis of the reverse rotation roller 26, and is pivotally supported its both ends to the pair of pivotally supporting bodies 24 above the reverse rotation roller 26 in such a manner that an outer periphery thereof comes into contact with the outer periphery of the reverse rotation roller 26. Accordingly, the forward rotation roller 27 is structured such that it rotates in a reverse direction to the rotating direction of the reverse rotation roller 26, that is, the same direction as the rotating direction of the spool 12, d of the rotation of the reverse rotation roller 26 in a reverse direction to the direction of the rotating axis of the spool 12.

[0027] The pinching roller 28 has a rotating axis which is parallel to the rotating axis of the forward rotation roller 27, and is pivotally supported its both ends to the pair of pivotally supporting bodies 24 above the forward rotation roller 27 in such a manner as to pinch the wire rod 11 which is fed out of the spool 12 together with the forward rotation roller 27. A rail 29 extending up and down is provided above a pivotally supporting point which pivotally supports the forward rotation roller 27 in each of the pair of pivotally supporting bodies 24, and a movable slider 31 is further provided in the rail 29. Both ends of the pinching roller 28 are pivotally supported to the sliders 31, and the pinching roller 28 is pivotally supported it both ends to the pair of pivotally supporting bodies 24, via the sliders 31.

[0028] Further, as shown in Fig. 3, the pivotally supporting body 24 is provided with a spring 32 which energizes the slider 31 toward the downward forward rotation roller 27, the pinching roller 28 is structured such that it pinches the wire rod 11 which is fed out of the spool 12 together with the forward rotation roller 27, on the basis of an energizing force of the spring 32. Accordingly, in the case that the forward rotation roller 27 rotates in the same direction as the rotating direction of the spool 12, the pinching roller 28 pinching the wire rod 11 together with the forward rotation roller 27 rotates in the reverse direction to the forward rotation roller 27, and the forward rotation roller 27 and the pinching roller 28 are structured such that they draw the wire rod 11 pinched by them from the spool 12. Further, the outer peripheries of the reverse rotation roller 26, the forward rotation, roller 27 and the

pinching roller 28 are formed by a resin such as a polyurethane or the like which does not apply any damage to the wire rod 11 even if the wire rod 11 comes into contact therewith so as to rob.

[0029] In this case, as shown in Fig. 2, the wire rod 11 which is drawn out of the spool 12 while being pinched by the rotating forward rotation roller 27 and pinching roller 28 is guided to a device which uses the wire rod 11, after passing between the pair of support posts 17a in the deflection sensor 17. In this embodiment, as shown in Fig. 2, a case that the wire rod 11 drawn out of the spool 12 so as to be fed is supplied to a winding machine 33 is exemplified, and the wire rod 11 is guided to a winding core 33b after passing through a wire guide 33a in the winding machine 33. Further, there is shown a case that the wire rod 11 fed out of the spool 12 is wound around the winding core 33b by rotating the winding core 33b in the winding machine 33.

[0030] Next, a description will be given of a slack preventing method for the wire rod in the present invention.

[0031] The slack preventing method for the wire rod 11 in the present invention is a slack preventing method for the wire rod 11 in the wire rod feeding machine 10 which feeds the wire rod 11 by rotating the spool 12 around which the wire rod 11 is wound, as shown in Fig. 4. Further, a characteristic point thereof exists in rotating the reverse rotation roller 26 having the rotating axis which is parallel to the rotating axis of the spool 12, in the reverse direction to the rotating direction of the spool 12 while being in contact with the spool 12, rotating the forward rotation roller 27 having the rotating axis which is parallel to the rotating axis of the reverse rotation roller 26, in the same direction as the spool 12 while being in contact with the reverse rotation roller 26, pinching the wire rod 11 which is fed out of the spool 12 by the pinching roller 28 having the rotating axis which is parallel to the rotating axis of the forward rotation roller 27 and the forward rotation roller 27, and drawing the wire rod 11 which is fed out due to the rotation of the spool 12, while pinching the wire rod 11 by the forward rotation roller 27 which rotates with the rotation of the spool 12, together with the pinching roller 28.

[0032] A description will be specifically given of the slack preventing method for the wire rod 11 according to the present invention which used the wire rod slack preventing device 20 mentioned above. Since the wire rod 11 is fed by rotating the spool 12, the wire rod slack preventing device 20 mentioned above is first of all installed in the vicinity of the winding machine 33 side of the wire rod feeding machine 10. The installation is carried out by arranging in a standing manner the pair of support posts 21 in the slack preventing device 20 in the outer sides of the pair of bases 13 in the wire rod feeding machine 10, and pinching the spool 12 by the pair of support posts 21 from both sides in the direction of the rotating axis. Further, the reverse rotation roller 26 is brought into contact with the outer periphery of the circular flange portion 12b in the spool 12 by moving up and down the pair of pivotally supporting bodies 24 to which the pinching roller 28, the forward rotation roller 27 and the reverse rotation roller 26 are pivotally supported. The upward and downward movement of the pair of pivotally supporting bodies 24 is carried out by moving up and down the movable members 22 which are provided in the pair of support posts 21 so as to be movable up and down, thereby moving up and down the pair of pivotally supporting bodies 24 together with the overhead transverse support bar 23.

[0033] At this time, as shown in Fig. 2, in the case that the pair of support posts 21 in the wire rod slack preventing device 20 are displaced to the winding machine 33 side (a leftward direction in Fig. 2) from the wire rod feeding machine 10, a contact position of the reverse rotation roller 26 with the flange portions 12b comes down, and in the case that the pair of support posts 21 are moved away from the winding machine 33 so as to be displaced to the wire rod feeding machine 10 side (a rightward direction in Fig. 2) and be moved close to the center of the spool 12, the contact position of the reverse rotation roller 26 with the flange portion 12b comes up. Accordingly, as specifically shown in Fig. 2, a position of the pair of support posts 21 of the wire rod slack preventing device 20 is adjusted in the winding machine 33 side of the wire rod feeding machine 10, in such manner that a portion between the pinching roller 28 and the forward rotation roller 27 is positioned at a locus which the wire rod 11 heading for the winding machine 33 from the spool 12 depicts.

[0034] Next, the wire rod 11 fed out of the spool 12 is inserted between the pinching roller 28 and the forward rotation roller 27, and the wire rod 11 fed out of the spool 12 is pinched by the pinching roller 28 and the forward rotation roller 27, the pinching roller 28 having the rotating axis which is parallel to the rotating axis of the forward rotation roller 27. Specifically, the pinching roller 28 is raised against the energizing force of the spring 32, a gap between the pinching roller 28 and the forward rotation roller 27 is expanded, and the wire rod 11 fed out of the spool 12 is inserted into the expanded gap. Further, the raised pinching roller 28 is again moved down, and the gap between the pinching roller 28 and the forward rotation roller 27 is reduced on the basis of the energizing force of the spring 32, whereby the wire rod 11 fed out of the spool 12 is pinched by the pinching roller 28 and the forward rotation roller 27. Accordingly, the installation of the wire rod slack preventing device 20 in the vicinity of the wire rod feeding machine 10 is finished.

[0035] Further, as shown in Fig. 2, the wire rod 11 is actually fed by rotating the spool 12, and is passed through the wire guides 33a in the winding machine 33 via the deflection sensor 17, and the end portion of the wire rod 11 is thereafter locked to the winding core 33b. In the feeding of the wire rod 11 from the spool 12, comparatively a lot of wire rod 11 is fed in correspondence to the deflection of the wire rod 11 between the winding machine 33 and the slack preventing device 20, and the rotation of the spool 12 is thereafter stopped. In this state,

the coil winding by the winding machine 33 is started, and the wire rod 11 is wound around the rotating winding core 33b. Since the fed wire rod 11 is previously wound around the winding core 33b in correspondence to the deflection, any force which pulls back the wound wire rod 11 to the spool 12 side is not applied. Accordingly, in comparison with the conventional structure in which the force pulling back the wound wire rod to the spool side is applied, it is possible to reduce a resistance against a motor which rotates the winding core 33b and is not illustrated. Further, it is possible to increase the rotating speed of the winding core 33b so as to carry out the coil winding at a comparatively high speed.

[0036] Since the wire rod 11 between the winding machine 33 and the slack preventing device 20 is wound around the winding core 33b by starting the coil winding, a degree of deflection in the wire rod 11 between them is reduced little by little. Further, as shown by a one-dot chain line in Fig. 2, the upper sensor 17c in the deflection sensor 17 detects the reduction of the deflection of the fed wire rod 11, the wire rod feeding machine 10 again rotates the spool 12 and again feeds the wire rod 11. In other words, in the case that the upper sensor 17c in the deflection sensor 17 detects the reduction of the deflection of the fed wire rod 11, any one or both of the pair of rollers 14 is rotated by driving the motor 16 in the wire rod feeding machine 10, the spool 12 which is mounted on the pair of rollers 14 and around which the wire rod 11 is wound is rotated, and the wire rod 11 is newly fed at an amount which is equal to or more than a winding amount around the winding core 33b.

[0037] As shown in Fig. 4, in the case that the spool 12 is rotated as shown by a solid arrow for feeding the wire rod 11, the reverse rotation roller 26 rotates in the reverse direction to the rotating direction of the spool 12 since the outer periphery of the reverse rotation roller 26 is in contact with the outer periphery of the circular flange portion 12b in the spool 12. Further, since the reverse rotation roller 26 has the rotating axis which is parallel to the rotating axis of the spool 12, and the forward rotation roller 27 having the rotating axis which is parallel to the rotating axis of the reverse rotation roller 26 is in contact with the reverse rotation roller 26, the forward rotation roller 27 rotates in the same direction as the spool 12 together with the rotation of the reverse rotation roller 26.

[0038] In this case, since the wire rod 11 fed out of the spool 12 is pinched by the pinching roller 28 and the forward rotation roller 27, the pinching roller 28 having the rotating axis which is parallel to the rotating axis of the forward rotation roller 27, and the forward rotation roller 27 has the same rotating direction as the rotating direction of the spool 12, the wire rod 11 which is fed due to the rotation of the spool 12 and is pinched by the forward rotation roller 27 and the pinching roller 28 is drawn out of the spool 12 by the forward rotation roller 27 which rotates in the same direction as the spool 12. Accordingly, it is possible to prevent the wire rod 11 which is fed by rotating the spool 12 from returning to the spool 12, whereby the fed wire rod 11 is not loosened in the spool 12, and it is possible to prevent the slack of the wire rod 11 in the spool 12. Further, since the pinching roller 28 and the forward rotation roller 27 are arranged in the direction in which the wire rod 11 heads for the winding machine 33 from the spool 12, the wire rod 11 which is pinched by the forward rotation roller 27 and the pinching roller 28 heads for the winding machine 33 without changing its direction. Accordingly, the direction of the wire rod 11 is not significantly changed by the pinching roller 28 and the forward rotation roller 27, and a curl is not generated in the wire rod 11 due to the change of the direction. Further, since the forward rotation roller 27 rotates together with the rotation of the spool 12, it is possible to make the other power than the power for rotating the spool 12 unnecessary.

[0039] Further, in the case that an amount of the wire rod 11 which is drawn out due to the forward rotation roller 27 becomes smaller than an amount of the wire rod 11 which is fed out due to the rotation of the spool 12, the wire rod 11 fed out of the spool 12 is loosened in the spool 12. However, since the reverse rotation roller 26 rotates while being in contact with the outer periphery of the spool 12, and the forward rotation roller 27 rotates while being in contact with the outer periphery of the reverser rotation roller 26, a moving speed of the outer surface of the forward rotation roller 27 pinching the wire rod 11 becomes identical to a moving speed in the outer periphery of the circular flange portion 12b of the spool 12 with which the reverse rotation roller 26 comes into contact.

[0040] On the other hand, since the flange portion 12b in the spool 12 is structured such as to prevent the wire rod 11 which is wound around the winding drum portion 12a of the spool 12 from deflecting from the winding drum portion 12a, an outer diameter of the flange portion 12b is generally larger than an outer diameter of the wire rod 11 which is wound around the winding drum portion 12a of the spool 12. Accordingly, in comparison with an amount of the wire rod 11 which is fed due to the rotation of the spool 12 and an unloosening of the wire rod 11 wound around the winding drum portion 12a, an amount of the wire rod 11 which is drawn by the forward rotation roller 27 which pinches the wire rod 11 together with the reverse rotation roller 26 and rotates in the same direction as the spool 12 becomes larger. Therefore, the amount of the wire rod 11 which is drawn on the basis of the rotation of the forward rotation roller 27 does not become smaller, in comparison with the amount of the wire rod 11 which is fed due to the rotation of the spool 12. As long as the outer diameter of the flange portion 12b with which the reverse rotation roller 26 comes into contact is larger than the outer diameter of the wire rod 11 which is wound around the winding drum portion 12a of the spool 12, it is possible to effectively prevent the wire rod 11 fed out of the spool 12 from being loosened in the spool 12.

[0041] As mentioned above, in the case that the outer

diameter of the flange portion 12b with which the reverse rotation roller 26 comes into contact is larger than the outer diameter of the wire rod 11 which is wound around the winding drum portion 12a of the spool 12, the amount of the wire rod 11 which is drawn on the basis of the rotation of the forward rotation roller 27 becomes larger, in comparison with the amount of the wire rod 11 which is fed due to the rotation of the spool 12, and an error is generated between the feeding amount and the drawing amount. However, since the reverse rotation roller 26 rotating the forward rotation roller 27 is structured such as to come into contact with the outer periphery in the flange portion 12b of the spool 12, the error can be absorbed by a slip between the reverse rotation roller 26 and the flange portion 12b in the spool 12, or a slip between the reverse rotation roller 26 and the forward rotation roller 27. Further, there is a case that a slip is generated between the wire rod 11 and the forward rotation roller 27 which pinches the wire rod 11 together with the pinching roller 28, thereby absorbing the error generated between the feeding amount and the drawing amount of the wire rod 11. However, since at least the outer periphery of the forward rotation roller 27 with which the wire rod 11 comes into contact is formed by the resin such as the polyurethane or the like which does not apply any damage to the wire rod 11, it is possible to securely prevent the slack of the wire rod 11 in the spool 12 without applying any damage to the wire rod 11 which is pinched and drawn by the forward rotation roller 27 and the pinching roller 28.

[0042] Further, the amount of deflection of the wire rod 11 between the winding machine 33 and the slack preventing device 20 is increased by making the amount of the wire rod 11 which is fed out of the spool 12 more than the amount of the wire rod 11 which the winding core 33b winds. As shown by a solid line in Fig. 2, in the case that the lower sensor 17b in the deflection sensor 17 detects a predetermined amount of slack of the fed wire rod 11, the newly feeding of the wire rod 11 from the spool 12 is inhibited by stopping the rotation of the spool 12. Further, it is possible to set comparatively a lot of wire rod 11 in an always fed state, as shown in Fig. 2, while preventing the slack of the wire rod 11 in the spool 12. Accordingly, for example, even in the case that a cross section of the winding core 33b around which the wire core 11 is wound is formed as a flat shape such as a rectangular shape, the winding speed of the wire rod 11 which is wound around the winding core 33b is significantly changed, and the movement and the stop are alternately repeated, the winding speed in the winding machine 33 does not depend on the feeding speed of the wire rod 11 in the wire rod feeding machine 10, and even in the case that the comparatively larger spool 12 is rotated, it is possible to sufficiently increase the winding speed of the winding machine 33 by setting comparatively a lot of wire rod 11 in the previously fed state.

List of references

[0043]

10 wire rod feeding machine
11 wire rod
12 spool
17 deflection sensor
20 slack preventing device for wire rod wound around spool
21 support post
23 transverse support bar
24 pivotally supporting body
26 reverse rotation roller
27 forward rotation roller
28 pinching roller

Claims

1. A slack preventing system comprising:

a wire rod feeding machine (10) that feeds a wire rod (11) by rotating a spool (12) around which the wire rod (11) is wound; and
a slack preventing device (20) installed parallel to the wire rod feeding machine (10), **characterised in that** the slack preventing device (20) includes:

a reverse rotation roller (26) having a rotating axis which is parallel to a rotating axis of the spool (12) and rotating in a reverse direction to a rotating direction of the spool (12) while being in contact with the spool (12);
a forward rotation roller (27) having a rotating axis which is parallel to a rotating axis of the reverse rotation roller (26) and rotating in the same direction as the spool (12) while being in contact with the reverse rotation roller (26); and
a pinching roller (28) having a rotating axis which is parallel to the rotating axis of the forward rotation roller (27) and pinching the wire rod (11), which is fed out of the spool (12), together with the forward rotation roller (27);
wherein the spool (12) has:

a columnar body portion (12a) around an outer periphery of which the wire rod (11) is wound; and
circular flange portions (12b) formed coaxially in both ends in an axial direction of the body portion (12a), an outer periphery of the reverse rotation roller (26) being in contact with outer periph-

eries of the circular flange portions (12b),

wherein an outer diameter of each of the circular flange portions (12b) is larger than an outer diameter of the wire rod (11) which is wound around the winding drum portion (12a) of the spool (12) so that an amount of the wire rod (11) which is drawn on the basis of the rotation of the forward rotation roller (27) becomes larger than an amount of the wire rod (11) which is fed due to the rotation of the spool (12), and
wherein an error which is generated between the feeding amount of the wire rod (11) and the drawing amount of the wire rod (11) is absorbed by a slip between the reverse rotation roller (26) and the circular flange portion (12b) in the spool (12) or a slip between the reverse rotation roller (26) and the forward rotation roller (27).

2. The slack preventing system according to claim 1, wherein the slack preventing device (20) further includes:

a pair of support posts (21) which are erected in such a manner as to pinch the spool (12), in which the rotating axis is set horizontally, from both sides in a direction of the rotating axis thereof;
a transverse support bar (23) which is provided to be bridged between the pair of support posts (21); and
a pair of pivotally supporting bodies (24) which are provided to the transverse support bar (23) to be spaced apart from each other at a wider distance than a width, in the direction of the rotating axis, of the spool (12),
wherein both end portions of the reverse rotation roller (26), both end portions of the forward rotation roller (27) and both end portions of the pinching roller (28) are rotatably supported by the pair of pivotally supporting bodies (24).

3. The slack preventing system according to claim 1 or 2,
wherein the wire rod feeding machine (10) is provided with a deflection sensor (17) which detects a deflection of the fed wire rod (11) in a non-contact manner, rotates the spool (12) when the deflection sensor (17) detects a reduction of the slack of the fed wire rod (11), and stops the rotation of the spool (12) when the deflection sensor (17) detects a predetermined amount of slack of the fed wire rod (11).

4. A slack preventing method for a wire rod feeding machine (10) which feeds a wire rod (11) by rotating a spool (12) around which the wire rod (11) is wound, the method being **characterised by** comprising:

rotating a reverse rotation roller (26), having a rotating axis which is parallel to a rotating axis of the spool (12), in a reverse direction to a rotating direction of the spool (12) while being in contact with the spool (12);
rotating a forward rotation roller (27), having a rotating axis which is parallel to the rotating axis of the reverse rotation roller (26), in the same direction as the spool (12) while being in contact with the reverse rotation roller (26) ;
pinching the wire rod (11) which is fed out of the spool (12) by a pinching roller (28) having a rotating axis which is parallel to the rotating axis of the forward rotation roller (27); and
drawing the wire rod (11) which is fed out due to the rotation of the spool (12), while pinching the wire rod (11) by the forward rotation roller (27), which rotates with the rotation of the spool (12), together with the pinching roller (28) ;
wherein the spool (12) has:

a columnar body portion (12a) around an outer periphery of which the wire rod (11) is wound; and
circular flange portions (12b) formed coaxially in both ends in an axial direction of the body portion (12a), an outer periphery of the reverse rotation roller (26) being in contact with outer peripheries of the circular flange portions (12b),

wherein an outer diameter of each of the circular flange portions (12b) is larger than an outer diameter of the wire rod (11) which is wound around the winding drum portion (12a) of the spool (12) so that an amount of the wire rod (11) which is drawn on the basis of the rotation of the forward rotation roller (27) becomes larger than an amount of the wire rod (11) which is fed due to the rotation of the spool (12), and
wherein an error which is generated between the feeding amount of the wire rod (11) and the drawing amount of the wire rod (11) is absorbed by a slip between the reverse rotation roller (26) and the circular flange portion (12b) in the spool (12) or a slip between the reverse rotation roller (26) and the forward rotation roller (27).

Patentansprüche

1. Lockerungsvermeidungssystem, umfassend:

eine Walzdrahtzuführmaschine (10), die einen Walzdraht (11) zuführt, indem eine Spule (12) gedreht wird, um die der Walzdraht (11) aufgewickelt ist; und
eine Lockerungsvermeidungsvorrichtung (20),

die parallel zu der Walzdrahtzuführmaschine (10) installiert ist, **dadurch gekennzeichnet, dass** die Lockerungsvermeidungsvorrichtung (20) einschließt:

eine Umkehrlaufwalze (26) mit einer Drehachse, die parallel zu einer Drehachse der Spule (12) ist und sich in einer umgekehrten Richtung zu einer Drehrichtung der Spule (12) dreht, während sie in Kontakt mit der Spule (12) ist;
eine Vorwärtslaufwalze (27) mit einer Drehachse, die parallel zu einer Drehachse der Umkehrlaufwalze (26) ist und sich in derselben Richtung wie die Spule (12) dreht, während sie in Kontakt mit der Umkehrlaufwalze (26) ist; und
eine Andruckwalze (28) mit einer Drehachse, die parallel zu der Drehachse der Vorwärtslaufwalze (27) ist und den Walzdraht (11), der aus der Spule (12) herausgeführt wird, zusammen mit der Vorwärtslaufwalze (27) andrückt;
wobei die Spule (12) aufweist:

einen säulenförmigen Körperabschnitt (12a), um dessen äußeren Umfang der Walzdraht (11) gewickelt ist; und
runde Flanschabschnitte (12b), die koaxial an beiden Enden in einer axialen Richtung des Körperabschnitts (12a) gebildet sind, wobei ein äußerer Umfang der Umkehrlaufwalze (26) in Kontakt mit äußeren Umfängen der runden Flanschabschnitte (12b) ist,

wobei ein Außendurchmesser von jedem der runden Flanschabschnitte (12b) größer als ein Außendurchmesser des Walzdrahts (11) ist, der um den Wickeltrommelabschnitt (12a) der Spule (12) aufgewickelt ist, so dass eine Menge des Walzdrahts (11), die basierend auf der Drehung der Vorwärtslaufwalze (27) abgezogen wird, größer als eine Menge des Walzdrahts (11) ist, die infolge der Rotation der Spule (12) zugeführt wird, und
wobei ein Fehler, der zwischen der Zuführmenge des Walzdrahts (11) und der Abzugmenge des Walzdrahts (11) entsteht, durch Schlupf zwischen der Umkehrlaufwalze (26) und dem runden Flanschabschnitt (12b) in der Spule (12) oder Schlupf zwischen der Umkehrlaufwalze (26) und der Vorwärtslaufwalze (27) absorbiert wird.

2. Lockerungsvermeidungssystem nach Anspruch 1, wobei die Lockerungsvermeidungsvorrichtung (20) ferner einschließt:

ein Paar Haltepfosten (21), die in einer solchen Weise aufgestellt sind, dass die Spule (12), in der die Drehachse horizontal festgelegt wird, von beiden Seiten in einer Richtung ihrer Drehachse angedrückt wird;
einen Querhaltestab (23), der so bereitgestellt wird, dass er brückenartig zwischen dem Paar der Haltepfosten (21) liegt; und
ein Paar von schwenkbaren Haltekörpern (24), die dem Querhaltestab (23) so bereitgestellt werden, dass sie in einem breiteren Abstand als eine Breite der Spule (12) in Richtung der Drehachse voneinander beabstandet sind,
wobei beide Endabschnitte der Umkehrlaufwalzen (26), beide Endabschnitte der Vorwärtslaufwalzen (27) und beide Endabschnitte der Andruckwalzen (28) drehbar durch das Paar der schwenkbaren Haltekörper (24) gehalten werden.

3. Lockerungsvermeidungssystem nach Anspruch 1 oder 2,
wobei die Walzdrahtzuführmaschine (10) mit einem Ablenksensor (17) ausgestattet ist, der eine Ablenkung des zugeführten Walzdrahts (11) in kontaktloser Weise detektiert, die Spule (12) dreht, wenn der Ablenksensor (17) eine Reduktion der Lockerung des zugeführten Walzdrahts (11) detektiert, und die Drehung der Spule (12) stoppt, wenn der Ablenksensor (17) eine vorbestimmte Menge an Lockerung des zugeführten Walzdrahts (11) detektiert.

4. Lockerungsvermeidungsverfahren für eine Walzdrahtzuführmaschine (10), die einen Walzdraht (11) zuführt, indem eine Spule (12) gedreht wird, um die der Walzdraht (11) aufgewickelt ist,
wobei das Verfahren **dadurch gekennzeichnet ist, dass** es umfasst:

Drehen einer Umkehrlaufwalze (26) mit einer Drehachse, die parallel zu einer Drehachse der Spule (12) ist, in einer umgekehrten Richtung zu einer Drehrichtung der Spule (12), während sie in Kontakt mit der Spule (12) ist;
Drehen einer Vorwärtslaufwalze (27) mit einer Drehachse, die parallel zu einer Drehachse der Umkehrlaufwalze (26) ist, in derselben Richtung wie die Spule (12), während sie in Kontakt mit der Umkehrlaufwalze (26) ist;
Andrücken des Walzdrahts (11), der aus der Spule (12) herausgeführt wird, durch eine Andruckwalze (28) mit einer Drehachse, die parallel zu der Drehachse der Vorwärtslaufwalze (27) ist; und
Abziehen des Walzdrahts (11), der infolge der Drehung der Spule (12) herausgeführt wird,

während der Walzdraht (11) durch die Vorwärtslaufwalze (27), die sich mit der Drehung der (12) Spule dreht, zusammen mit der Andruckwalze (28) angedrückt wird;
wobei die Spule (12) aufweist:

einen säulenförmigen Körperabschnitt (12a), um dessen äußeren Umfang der Walzdraht (11) gewickelt ist; und
runde Flanschabschnitte (12b), die koaxial an beiden Enden in einer axialen Richtung des Körperabschnitts (12a) gebildet sind, wobei ein äußerer Umfang der Umkehrlaufwalze (26) in Kontakt mit äußeren Umfängen der runden Flanschabschnitte (12b) ist, wobei ein Außendurchmesser von jedem der runden Flanschabschnitte (12b) größer als ein Außendurchmesser des Walzdrahts (11) ist, der um den Wickeltrommelabschnitt (12a) der Spule (12) aufgewickelt ist, so dass eine Menge des Walzdrahts (11), die basierend auf der Drehung der Vorwärtslaufwalze (27) abgezogen wird, größer als eine Menge des Walzdrahts (11) ist, die infolge der Rotation der Spule (12) zugeführt wird, und
wobei ein Fehler, der zwischen der Zuführmenge des Walzdrahts (11) und der Abzugmenge des Walzdrahts (11) entsteht, durch Schlupf zwischen der Umkehrlaufwalze (26) und dem runden Flanschabschnitt (12b) in der Spule (12) oder Schlupf zwischen der Umkehrlaufwalze (26) und der Vorwärtslaufwalze (27) absorbiert wird.

Revendications

1. Système de prévention de mou comprenant :

une machine d'alimentation en fil machine (10) qui fournit un fil machine (11) en faisant tourner une bobine (12) autour de laquelle le fil machine (11) est enroulé ; et
un dispositif de prévention de mou (20) installé parallèlement à la machine d'alimentation en fil machine (10), **caractérisé en ce que** le dispositif de prévention de mou (20) comprend :

un rouleau à rotation inverse (26) ayant un axe de rotation qui est parallèle à un axe de rotation de la bobine (12) et tournant dans une direction inverse à une direction de rotation de la bobine (12) tout en étant en contact avec la bobine (12) ;
un rouleau à rotation vers l'avant (27) ayant un axe de rotation qui est parallèle à un axe de rotation du rouleau à rotation inverse (26) et tournant dans la même direction que la bobine (12) tout en étant en contact avec le rouleau à rotation inverse (26) ; et
un rouleau pinceur (28) ayant un axe de rotation qui est parallèle à l'axe de rotation du rouleau à rotation vers l'avant (27) et pinçant le fil machine (11) qui est sorti de la bobine (12), conjointement avec le rouleau à rotation vers l'avant (27) ;
dans lequel la bobine (12) comporte :

une partie de corps en forme de colonne (12a) autour d'une périphérie externe de laquelle le fil machine (11) est enroulé ; et
des parties brides circulaires (12b) formées coaxialement dans les deux extrémités dans une direction axiale de la partie de corps (12a), une périphérie externe du rouleau à rotation inverse (26) étant en contact avec des périphéries externes des parties brides circulaires (12b),

dans lequel un diamètre externe de chacune des parties brides circulaires (12b) est plus important qu'un diamètre externe du fil machine (11) qui est enroulé autour de la partie tambour d'enroulement (12a) de la bobine (12) de telle sorte qu'une quantité de fil machine (11) qui est tirée sur la base de la rotation du rouleau à rotation vers l'avant (27) soit plus importante qu'une quantité de fil machine (11) qui est transmise en raison de la rotation de la bobine (12), et
dans lequel une erreur qui est générée entre la quantité d'alimentation du fil machine (11) et la quantité d'étirage du fil machine (11) est absorbée par un glissement entre le rouleau à rotation inverse (26) et la partie bride circulaire (12b) dans la bobine (12) ou par un glissement entre le rouleau à rotation inverse (26) et le rouleau à rotation vers l'avant (27) .

2. Système de prévention de mou selon la revendication 1,
dans lequel le dispositif de prévention de mou (20) comprend en outre :

une paire de montants de support (21) qui sont érigés de telle manière à pincer la bobine (12), dans laquelle l'axe de rotation est défini horizontalement, à partir des deux côtés dans une direction de l'axe de rotation de cette dernière ;
une barre de support transversale (23) qui est disposée de sorte à faire la liaison entre la paire de montants de support (21) ; et
une paire de corps de support pivotants (24) qui sont disposés sur la barre de support transver-

sale (23) de sorte à être espacés l'un de l'autre sur une distance plus étendue qu'une largeur, dans la direction de l'axe de rotation, de la bobine (12),
dans lequel les deux parties d'extrémité du rouleau à rotation inverse (26), les deux parties d'extrémité du rouleau à rotation vers l'avant (27) et les deux parties d'extrémité du rouleau pinceur (28) sont supportées en rotation par la paire de corps de support pivotants (24).

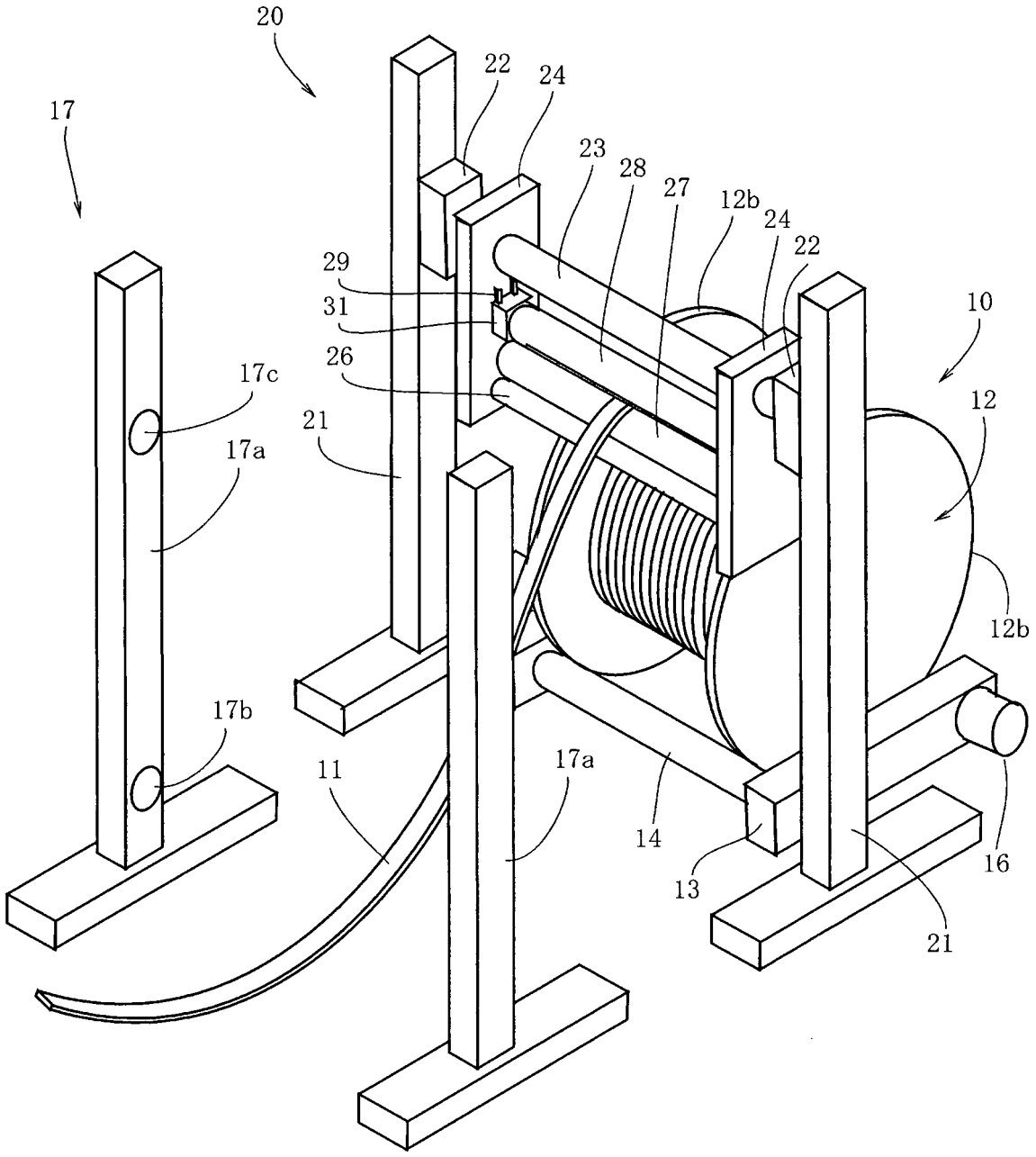
3. Système de prévention de mou selon la revendication 1 ou 2,
dans lequel la machine d'alimentation en fil machine (10) est pourvue d'un capteur de déviation (17) qui détecte une déviation du fil machine transmis (11) sans contact, fait tourner la bobine (12) lorsque le capteur de déviation (17) détecte une diminution du mou du fil machine transmis (11) et arrête la rotation de la bobine (12) lorsque le capteur de déviation (17) détecte une quantité prédéterminée de mou du fil machine transmis (11).

4. Procédé de prévention de mou pour une machine d'alimentation en fil machine (10) qui fournit un fil machine (11) en faisant tourner une bobine (12) autour de laquelle le fil machine (11) est enroulé ;
le procédé étant **caractérisé en ce qu'**il consiste :

à faire tourner un rouleau à rotation inverse (26), ayant un axe de rotation qui est parallèle à un axe de rotation de la bobine (12), dans une direction inverse à une direction de rotation de la bobine (12) tout en étant en contact avec la bobine (12) ;
à faire tourner un rouleau à rotation vers l'avant (27), ayant un axe de rotation qui est parallèle à l'axe de rotation du rouleau à rotation inverse (26), dans la même direction que la bobine (12) tout en étant en contact avec le rouleau à rotation inverse (26) ;
à pincer le fil machine (11) qui est sorti de la bobine (12) au moyen d'un rouleau pinceur (28) ayant un axe de rotation qui est parallèle à l'axe de rotation du rouleau à rotation vers l'avant (27) ; et
à tirer le fil machine (11) qui est sorti en raison de la rotation de la bobine (12) tout en pinçant le fil machine (11) au moyen du rouleau à rotation vers l'avant (27), qui tourne avec la rotation de la bobine (12), conjointement avec le rouleau pinceur (28) ;
dans lequel la bobine (12) comporte :

une partie de corps en forme de colonne (12a) autour d'une périphérie externe de laquelle le fil machine (11) est enroulé ; et
des parties brides circulaires (12b) formées coaxialement dans les deux extrémités dans une direction axiale de la partie de corps (12a), une périphérie externe du rouleau à rotation inverse (26) étant en contact avec des périphéries externes des parties brides circulaires (12b),
dans lequel un diamètre externe de chacune des parties brides circulaires (12b) est plus important qu'un diamètre externe du fil machine (11) qui est enroulé autour de la partie tambour d'enroulement (12a) de la bobine (12) de telle sorte qu'une quantité de fil machine (11) qui est tirée sur la base de la rotation du rouleau à rotation vers l'avant (27) soit plus importante qu'une quantité de fil machine (11) qui est transmise en raison de la rotation de la bobine (12), et
dans lequel une erreur qui est générée entre la quantité d'alimentation du fil machine (11) et la quantité d'étirage du fil machine (11) est absorbée par un glissement entre le rouleau à rotation inverse (26) et la partie bride circulaire (12b) dans la bobine (12) ou par un glissement entre le rouleau à rotation inverse (26) et le rouleau à rotation vers l'avant (27) .

Fig. 1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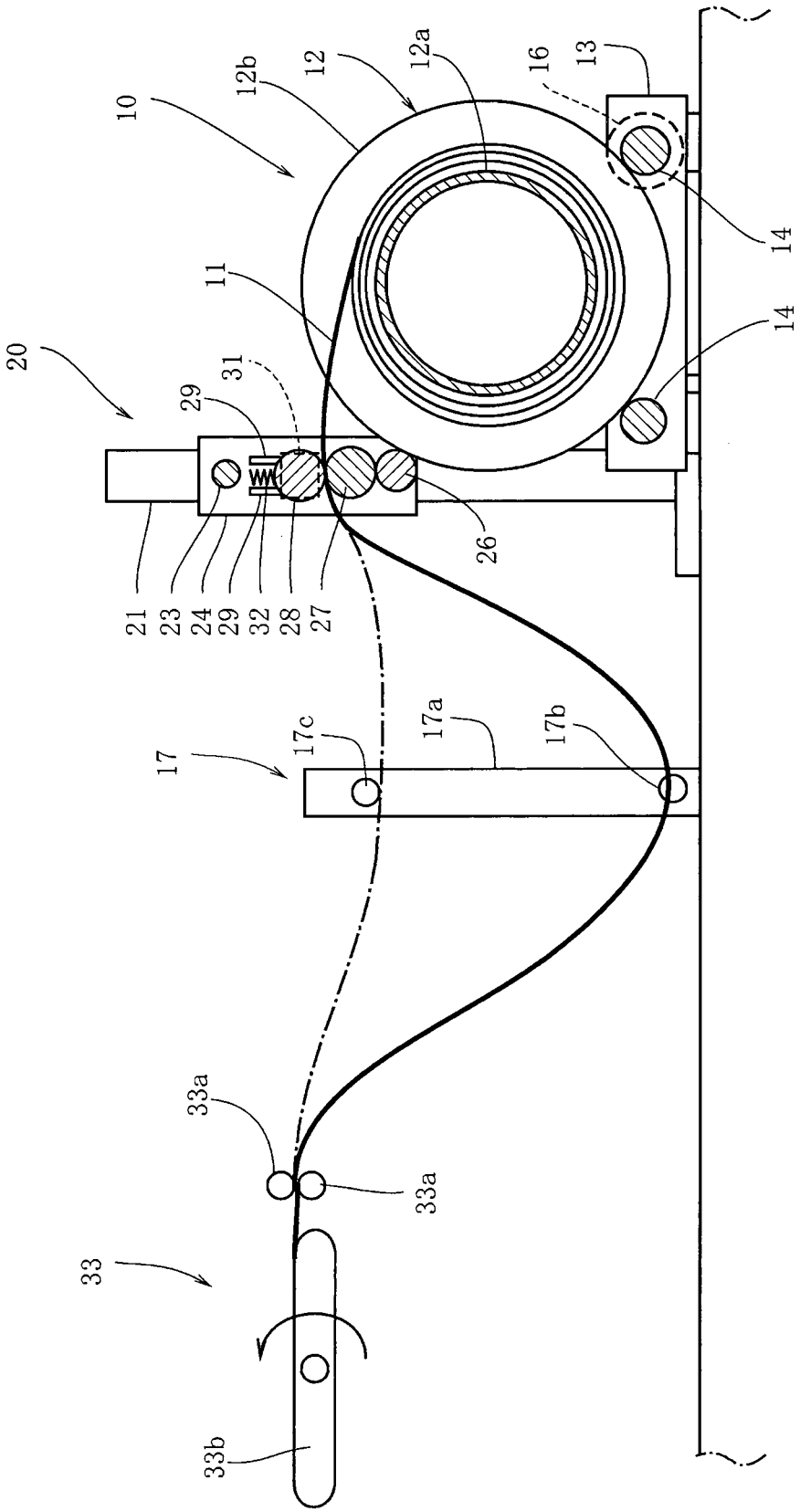
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Fig. 2

Fig. 3

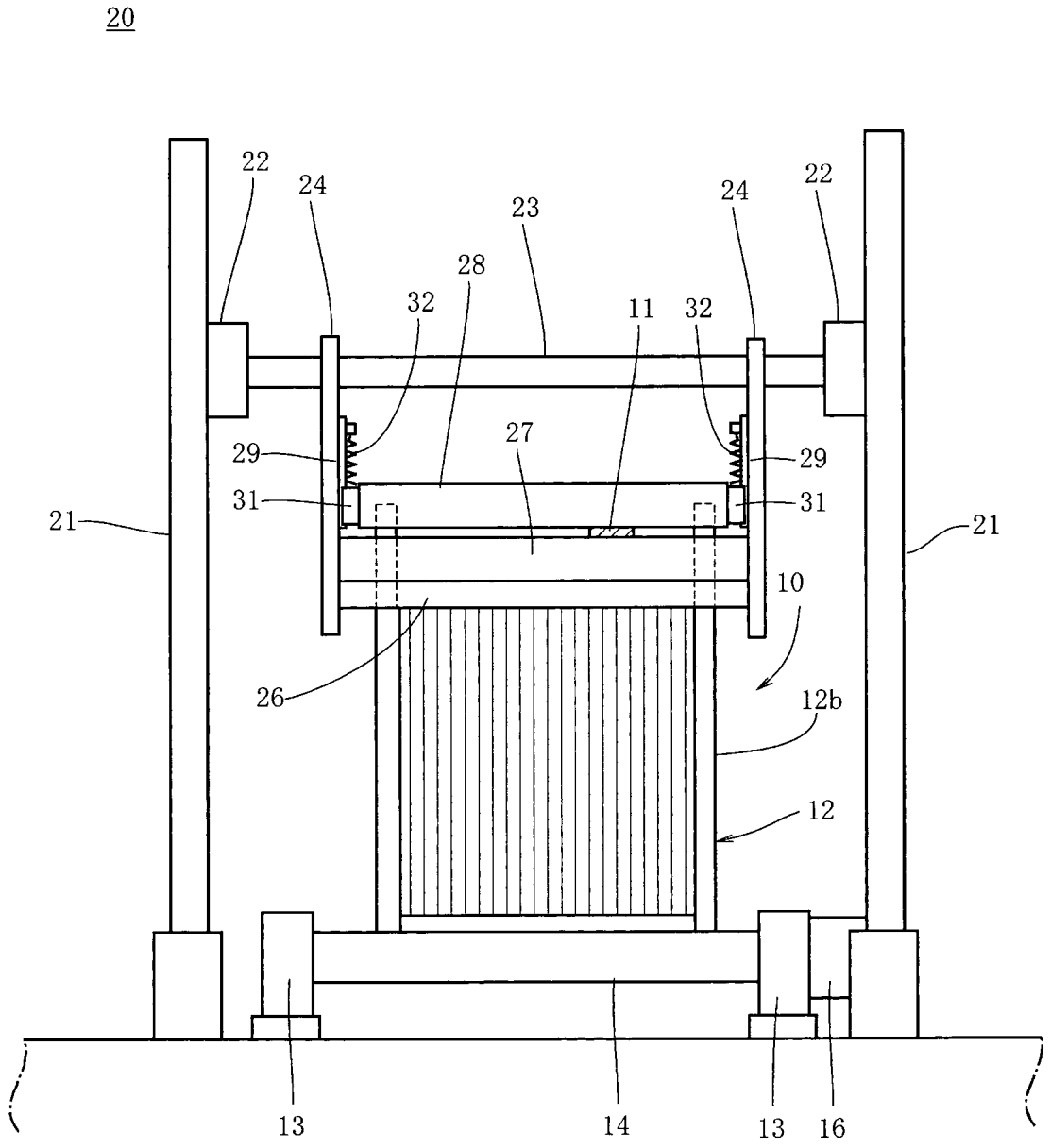
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Fig. 4

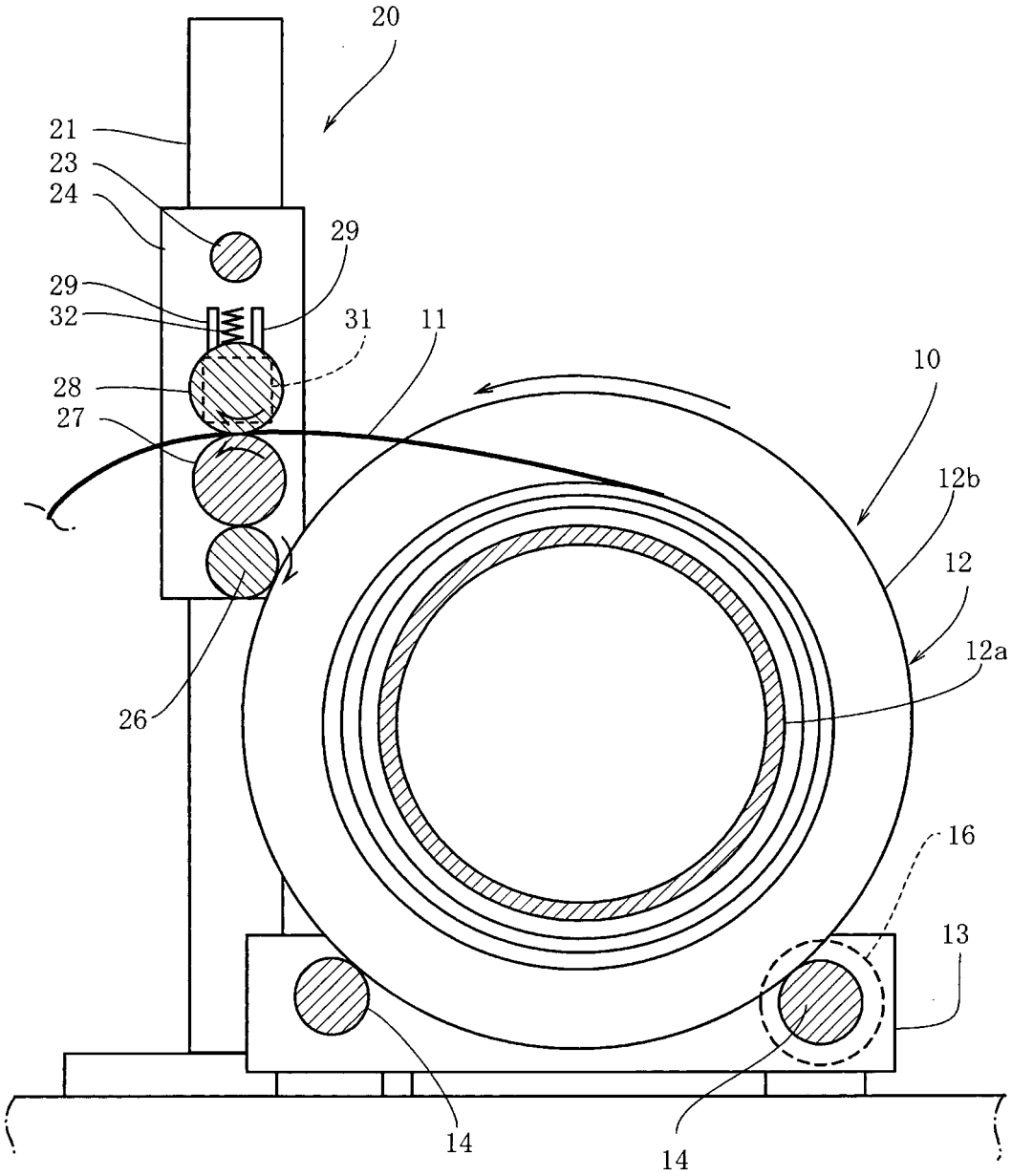
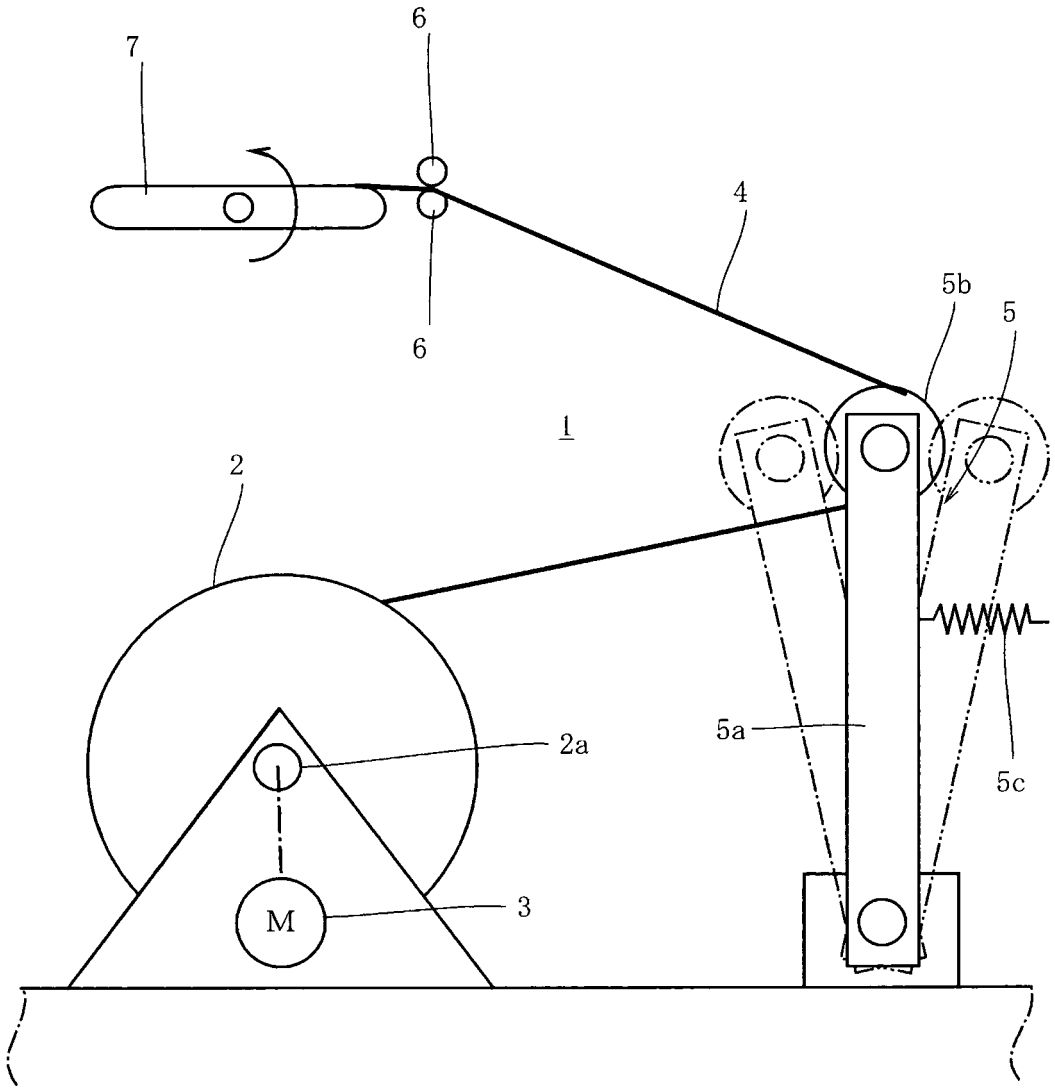


Fig. 5



REFERENCES CITED IN THE DESCRIPTION

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