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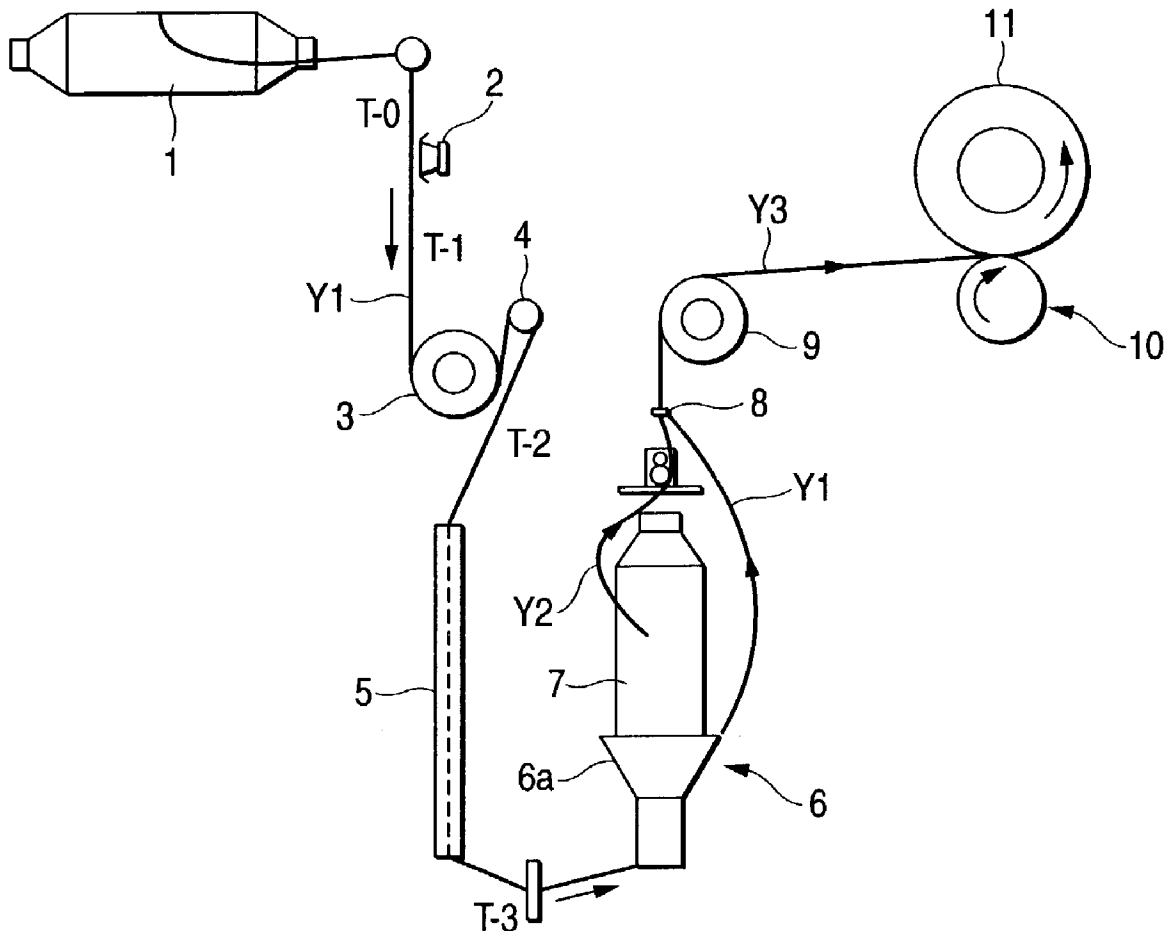


FIG. 1

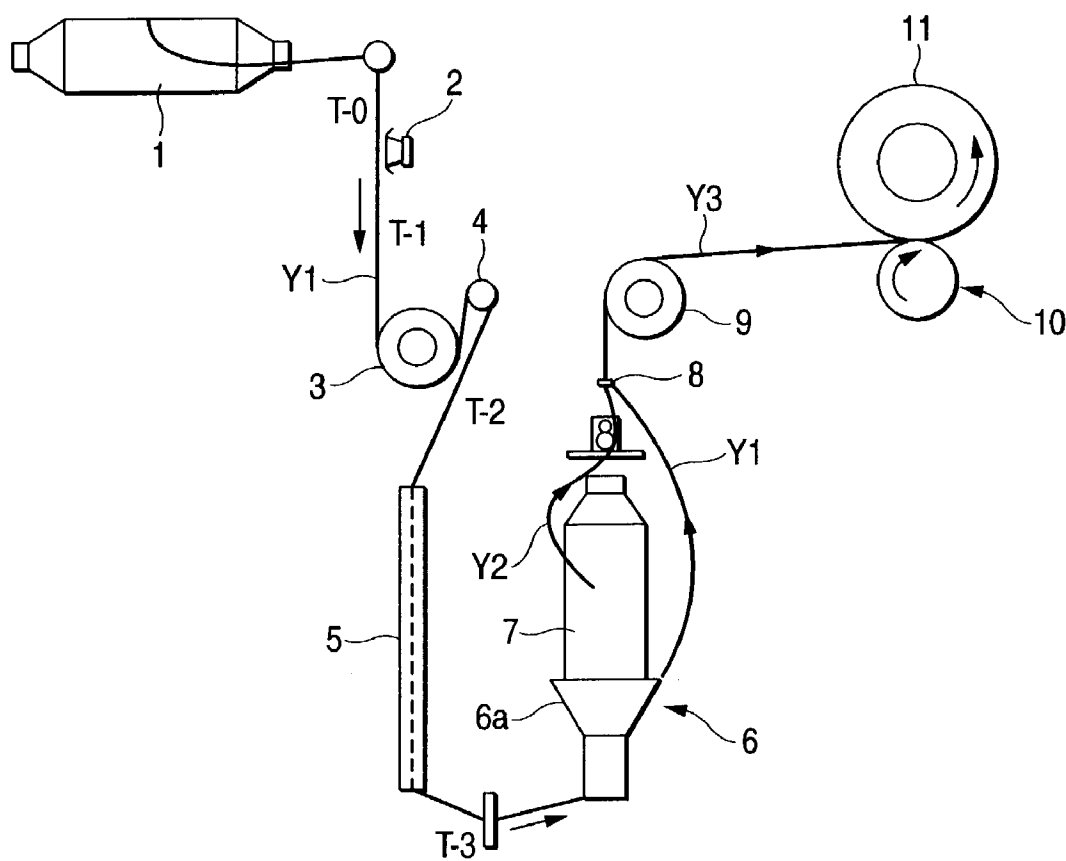


FIG. 2

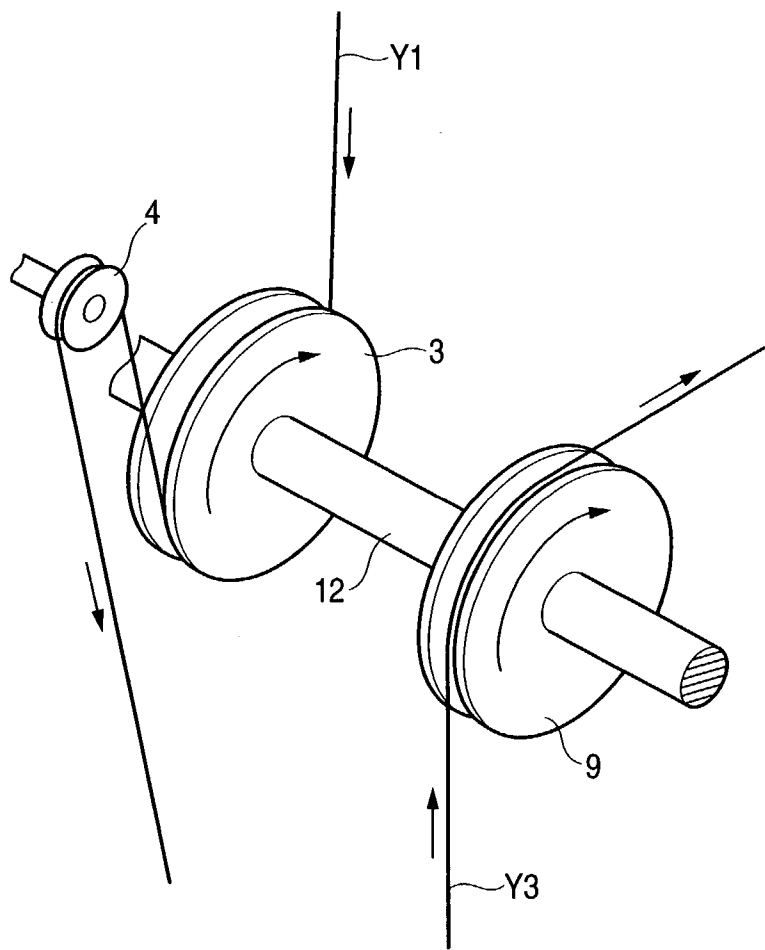


FIG. 3

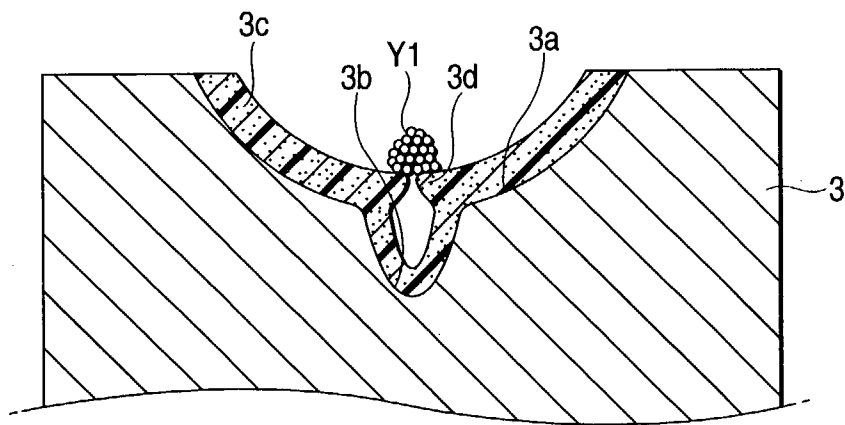


FIG. 4

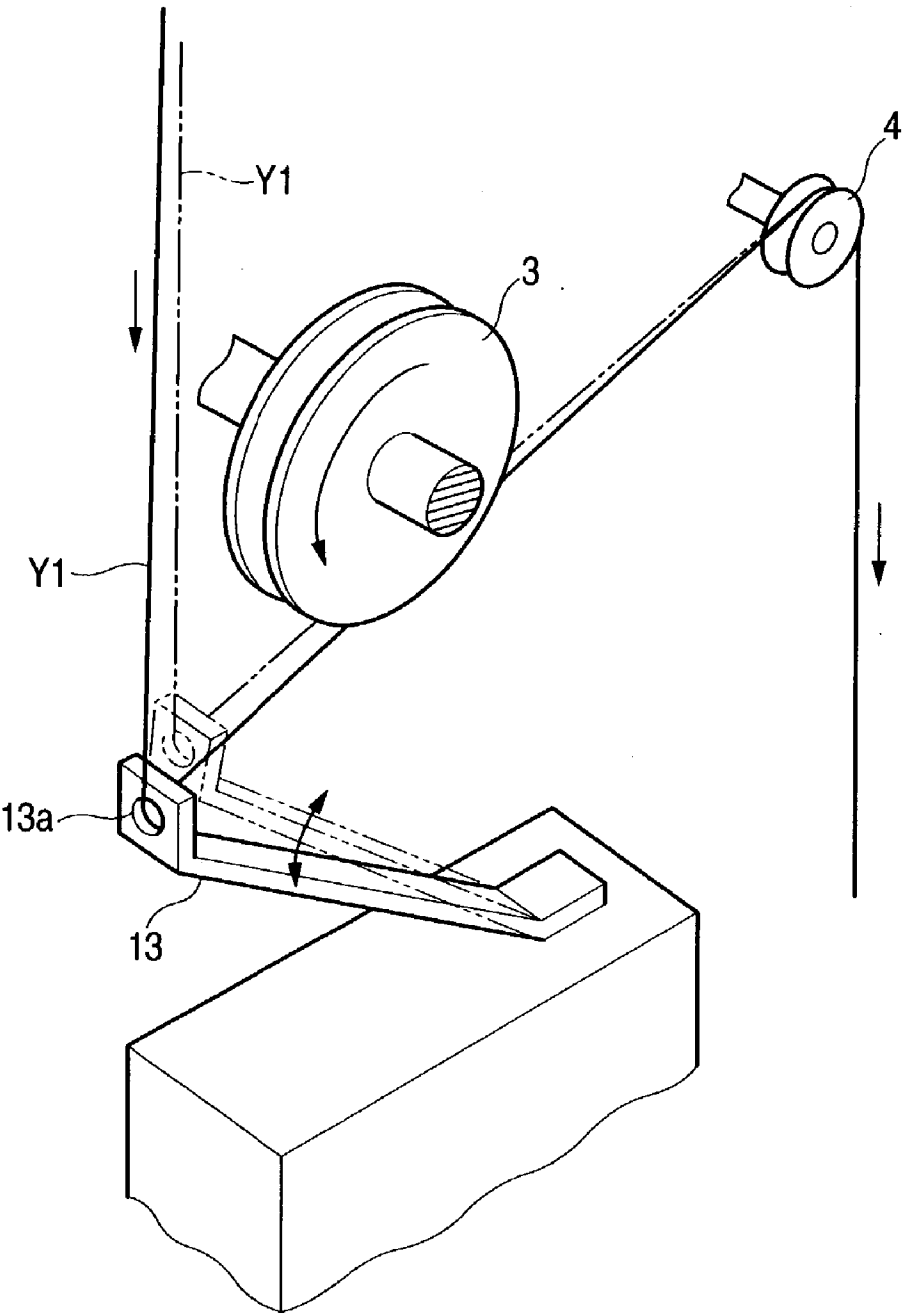
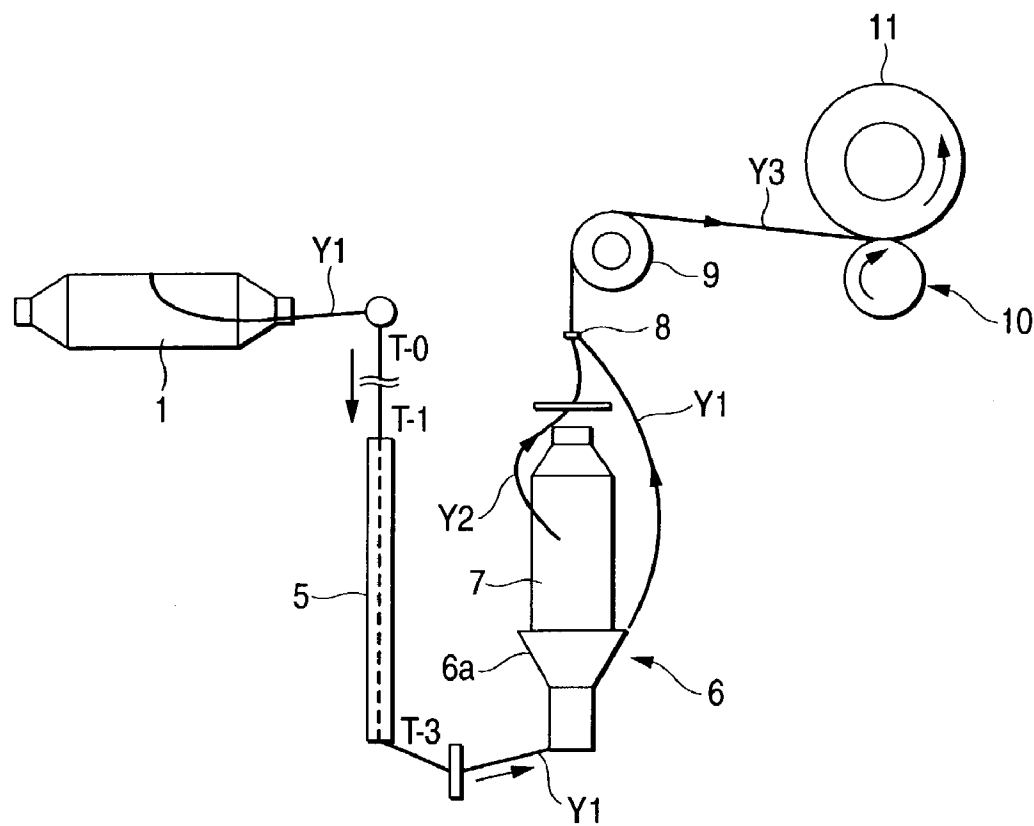


FIG. 5



THREAD BREAKAGE PREVENTING APPARATUS AND YARN PROCESSING MACHINE HAVING THREAD BREAKAGE PREVENTING UNITS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a thread breakage preventing apparatus which can be suitably applied to various thread plying machines or various machines for manufacturing multiplied yarns or finished yarns, and more particularly to a thread breakage preventing apparatus capable of effectively preventing a thread breakage which occurs frequently with an increase in the speed of these manufacturing machines for various filament yarns and various yarn processing machines including the thread breakage preventing apparatus.

[0003] 2. Description of the Related Art

[0004] In recent years, an increase in the speed and uninhabitation of processing machines for this kind of yarn, particularly, various filament yarns have been remarkable. For example, generally, two multifilament yarns are plied by using a conventional thread plying machine referred to as a cable twister to manufacture a sewing thread. Currently, a pirn to be applied to the twisting machine has a great weight of 3 kg (a thread length of approximately 180,000 m) and is large-sized. During an operation, the number of rotations of a twisting spindle is 9,000 rpm at most. A trial to increase the number of rotations of the twisting spindle to 11,000 rpm has been made in order to further enhance a productivity by using a large-sized pirn of the same kind.

[0005] With reference to FIG. 5, a plying mechanism for the conventional cable twister will be briefly described. A large-sized thread feeding pirn 7 is coaxially supported on a twisting spindle 6, while a further large-sized thread feeding pirn 1 of the same kind is supported on a creel which is not shown. A first original thread Y1 led from the thread feeding pirn 1 of the creel is once fed into the twisting spindle 6 and is then led to the outside, and is guided to a winding portion 10 through a balloon guide 8 provided just above the twisting spindle 6. At this time, the first original thread Y1 is rotated around the thread feeding pirn 7 supported on the twisting spindle 6 and is guided to a balloon guide 9 while forming a balloon. On the other hand, a second original thread Y2 taken directly from the thread feeding pirn 7 supported on the twisting spindle 6 is also guided to the winding portion 10 through the balloon guide 9 at the same time. Therefore, the first and second original threads Y1 and Y2 are plied in the balloon guide 9 portion and a twine Y3 is wound upon the winding portion 10.

[0006] By a thread plying machine having such a plying mechanism, particularly, in the case in which the first original thread wound upon the thread feeding pirn supported on the creel is a yarn which is uniform over a whole length (approximately 180,000 m) and has high quality, tension control is carried out with high precision. Alternatively, if the design of the inside and outside structures of the spindle and peripheral attached apparatuses is changed, the plying can be carried out without a particular hindrance even if the twisting spindle is rotated at a certain high speed of 9,000 rpm or more.

[0007] However, there are drawbacks that a yarn of high quality is also fuzzy locally due to the generation of a twist

during thread feeding in the thread feeding guide mechanism of the first original thread or a pile is formed due to a torsion during the running of the yarn. For this reason, when the drawback portions are accidentally caught in a guide on a yarn running path, a great tension is thus generated between the guide and a thread plying spindle on the downstream side thereof. Accordingly, the tension also influences a balloon, and the maximum diameter of the balloon becomes smaller than a preset permissible diameter to interfere with the peripheral apparatuses provided around the lead-in and lead-out portions of the first original thread to be sent to the twisting spindle. In such a case, the thread may be instantaneously cut simultaneously with the interference. Such a situation often occurs.

[0008] This situation is particularly apt to be caused in the case in which the first original thread is a multifilament yarn. In addition, the thread breakage is generated for various reasons instantaneously with an increase in the tension. As in various tension regulating apparatuses or controllers which have conventionally been known, therefore, a control portion is operated after the abnormality of the tension is detected, which is too late. Consequently, the thread breakage cannot be prevented at all. Even if yarns of high quality are to be plied, it is impossible to avoid the situation only by a conventional control method or design change.

SUMMARY OF THE INVENTION

[0009] The invention has an object to provide a thread breakage preventing apparatus capable of eliminating the generation of the situation as much as possible to carry out a high-speed operation, and furthermore, an object to provide a thread plying machine to be a kind of a typical yarn processing machine to which the thread breakage preventing apparatus is effectively applied.

[0010] The most effective means for attaining the objects was investigated variously and many tests were conducted. As a result, it was concluded that the generation of the thread breakage can be prevented by avoiding the influence of a fluctuation in an abnormal tension on a first original thread after introduction into a thread plying spindle even if the abnormal tension is generated due to some drawback as described above in the middle of a thread feeding mechanism for a first original thread.

[0011] In order to prevent the abnormal tension from reaching the first original thread after the introduction into the thread plying spindle, it is preferable that the tension should be relieved immediately before the first original thread is introduced into the thread plying spindle. However, if a fluctuation in the tension is detected and the tension is then relieved as in an ordinary tension controller, the thread breakage might be generated. In order to avoid the generation, it is always necessary to relieve the tension immediately before the introduction into the thread plying spindle in conformity with the fluctuation in the tension, particularly, an increased tension.

[0012] In order to relieve the tension, furthermore, it is necessary to first determine an area between a thread feeding section and the thread plying spindle in which the fluctuation in the tension is generated, thereby deciding a position in which the relieving means is to be provided. As a result of various experiments, it was found that the fluctuation in the tension is caused by nonuniformity based on the quality of

a yarn which is pile-shaped due to a fuzz or the twist of a part of a constitutional fiber and the nonuniformity of a yarn configuration such as the local loop ball of a yarn which is generated by a twist based on the sectional shape of the constitutional fiber of a yarn or a thread feeding mechanism from the thread feeding portion to the thread plying spindle.

[0013] It was found that an abnormal tension is generated when the original threads wound upon a thread feeding pin are tangled due to the nonuniformity of the quality of the yarn so that the original thread is not smoothly led out of the thread feeding pin or the nonuniform portion of the yarn configuration is caught in a guide provided in the middle of the yarn running path and is not untwisted by an ordinary lead-out tension.

[0014] Based on the result, it is sufficient that the means for relieving the tension is provided at least on the yarn running path from the thread feeding portion to the introducing portion of the twisting spindle in any case. Furthermore, it is preferable that the tension relieving means should be provided on the downstream side of the guide portion disposed close to the thread feeding portion side. Even if by a simple tenser such as a conventional spring or dancer roller or conventional control means for increasing the rotating speed of a feed roller in response to an instruction sent from a control portion based on the detection signal of a tension detector to overfeed a yarn is employed as the tension relieving means, however, a great tension fluctuation cannot be absorbed completely or control cannot follow the propagation time of the tension fluctuation to the twisting spindle.

[0015] Accordingly, the tension relieving means is neither a tenser for simply absorbing a tension like a conventional tensor or control means nor control means for increasing thread feeding after ascertaining the tension fluctuation, and it is necessary to develop completely new relieving means. As a result of further various investigations, the invention was finally finished.

[0016] More specifically, as described in the first aspect of the invention, the basic structure of a thread breakage preventing apparatus is characterized by comprising a thread breakage preventing apparatus including a tension relieving unit disposed on a running path of a yarn and serving to positively feed the yarn to a downstream side in a feeding amount corresponding to a tension of the yarn when the tension exceeds a preset tension.

[0017] In a yarn processing machine such as a multiplied yarn manufacturing machine or a thread plying machine, usually, an almost constant tension is given to a yarn running between a thread feeding portion and a processing portion and finely fluctuates by the influence of the vibration of a machine or peripheral apparatuses or a fluctuation in the dynamic frictional force of the running yarn. However, the amount of the fluctuation is very fine if nothing intervenes as described above. The fluctuation in the tension can fully be absorbed and relieved by the spring tenser.

[0018] The tension relieving unit in the thread breakage preventing apparatus according to the invention neither absorbs nor relieves a fluctuation in a tension by elastic force differently from the spring sensor but is more suitably applied to a great tension fluctuation than a fine tension fluctuation generated during thread feeding in a stationary state described above. For example, in a processing machine

such as a thread plying machine for giving a twist to a yarn while generating ballooning by the rotation of a twisting spindle, the diameter of the balloon is determined by the rotating speed of the twisting spindle, the weight of a yarn and the tension of the yarn. In order to determine the diameter of the balloon within a predetermined range, it is necessary to set the rotating speed of the twisting spindle and the yarn tension to have corresponding values in the case of a yarn of the same kind.

[0019] Usually, the rotating speed is set and the tension range of the yarn is then set, and the yarn tension to be applied from the thread feeding portion to the thread plying spindle is regulated by means of a spring tenser or a ball tenser. When the yarn tension becomes lower than a set tension, the diameter of the balloon is increased to exceed a pitch (an installation space) between adjacent spindles. The tension can be regulated to be equal to or higher than the set tension comparatively easily by means of the tenser. On the other hand, when the tension exceeds the set tension, the diameter of the balloon is reduced. If the diameter is reduced, the yarn lead-out portion of the balloon comes in contact with peripheral tools, and particularly, a multifilament yarn is cut instantaneously.

[0020] In order to avoid this situation, it is necessary to relieve a yarn tension before a tension fluctuation reaches the yarn introducing portion of the twisting spindle when the tension fluctuation is generated as described above. In the relieving unit according to the invention, therefore, at the same time that a tension fluctuation exceeding a preset tension is generated, a yarn is positively fed to the downstream side in a feeding amount corresponding to the tension fluctuation without a time difference by utilizing the tension. As a result, the tension fluctuation of the yarn is relieved instantaneously on the downstream side of the relieving means according to the invention. For example, the yarn to be introduced into the twisting spindle maintains an ordinary set tension, and does not influence the formation of a balloon and holds a predetermined balloon configuration. Thus, plying can be smoothly carried out without the generation of a thread breakage.

[0021] A second aspect of the invention is directed to the thread breakage preventing apparatus, wherein the tension relieving unit is a rotational roller to be rotated at a constant rotating speed, the rotational roller having yarn feeding amount increasing and decreasing portion for instantaneously increasing and decreasing the feeding amount of the yarn based on a behavior of the yarn corresponding to an increase and decrease in the tension of the yarn.

[0022] When the tension of the yarn is increased, the yarn is strained. When the tension is decreased, the yarn is loosened. In the invention, the behavior based on the tension fluctuation of the yarn is utilized and the rotational roller to be driven and rotated at a constant rotating speed is employed as the tension relieving unit. In addition, the rotational roller includes the yarn feeding amount increasing and decreasing portion. For example, it is possible to employ, as the yarn feeding amount increasing and decreasing portion, a spring having the peripheral surface of a roller by an elastic material and serving to change the pressure contact amount and force of the yarn based on the tension fluctuation of the yarn. By changing the pressure contact force, the amount of slip of the yarn coming in contact with

the peripheral surface of the rotational roller from the peripheral surface of the roller fluctuates so that the yarn feeding amount is varied by the pressure contact force.

[0023] A third aspect of the invention is directed to the thread breakage preventing apparatus, wherein the yarn feeding amount increasing and decreasing portion further includes a taking and feeding structure of the yarn for leading out the yarn against a fluctuation in the tension when an abnormal tension of the yarn is generated and for instantaneously feeding the yarn in a necessary feeding amount to a downstream side.

[0024] In the case in which the peripheral surface of the rotational roller is caused to carry the yarn at a certain circular angle, the contact force for the peripheral surface of the roller is increased so that the yarn tries to be moved in a central direction as described above when the tension of the yarn is increased. For example, as the taking and feeding structure of the yarn, a U-shaped groove is formed in the circumferential direction of the peripheral surface of the rotational roller, and furthermore, a groove having a V-shaped section is formed along a bottom surface thereof. An elastic layer having a desirable thickness is formed over the whole surface of the groove. Furthermore, there is formed a rib-shaped peak-like bulged portion overhanging from the ridge of the intersecting portion between the U-shaped section of the groove and the V-shaped section into the V-shaped groove. In this case, it is preferable that the bulged portion should have an almost triangular section having the extended surface of the bottom face of the U-shaped groove or a U-shaped portion of the elastic layer to be one side.

[0025] If the tension fluctuation of the yarn carried on the peripheral surface of the rotational roller and running with the rotation of the roller ranges within a preset tension, the yarn is caused to come in contact with the peripheral surface of the roller by pressure contact force corresponding to the tension and is fed in a predetermined feeding amount toward the downstream side. When the tension becomes an abnormal tension exceeding the preset range, the pressure contact force acting in the direction of the roller center which is applied to the yarn overcomes the support force of the bulged portion of the elastic layer so that the bulged portion is elastically deformed and is thus guided to the V groove portion, and is strongly gripped in the bottom portion of the V groove portion. Consequently, the yarn on the upstream side is positively taken by the rotation of the rotational roller and is reliably fed toward the downstream side. As a result, the abnormal tension is not transmitted to the yarn introducing portion of the twisting spindle, for example, so that the yarn is not cut.

[0026] A fourth aspect of the invention is directed to a yarn processing machine including a thread feeding portion and a yarn processing portion and having the thread breakage preventing apparatus according to any of the first to third aspects of the invention which is provided on a yarn running path between the thread feeding portion and the yarn processing portion. Examples of the yarn processing machine include manufacturing machines and thread plying machines for bulky finished yarns and various multiple finished yarns, and particularly, a thread plying machine to be a typical yarn processing machine is defined in the fifth aspect of the invention.

[0027] A fifth aspect of the invention is directed to a thread plying machine having the thread breakage preventing apparatus according to the first to third aspects of the invention which is provided on a yarn running path between the thread feeding portion and the twisting spindle, and further including a feed roller provided between the twisting spindle and a twine winding portion and serving to overfeed a twine to the twine winding portion.

[0028] In the thread plying machine, the yarn is rotated around the spindle while forming a balloon between the yarn introducing portion of the twisting spindle and the balloon guide provided just above the same spindle, and is twisted in the balloon guide portion and is thus wound upon the winding portion. In general, the yarn is led out of the twisting spindle with the winding tension of the winding portion. At this time, the tension of the yarn applied to the balloon is generated by the centrifugal force of the yarn, and furthermore, the length of the twine passing through the balloon guide becomes smaller than that of the original thread obtained before the balloon guide. Consequently, the tension of the yarn becomes higher than the preset winding tension. In the invention, in addition to the thread breakage preventing apparatus, the feed roller for overfeeding is provided between the twisting spindle and the twine winding portion to prevent the breakage of the original thread and to wind the twine with a preset winding hardness.

[0029] A sixth aspect of the invention is directed to the thread plying machine, wherein the tension relieving unit is a rotational roller to be rotated at a predetermined rotating speed, and the feed roller has the same structure as a structure of the rotational roller and the rotational roller and the feed roller are supported on an identical rotating shaft. The feed roller winds the twine with a preset winding hardness as described above. Therefore, the twine passing through the balloon guide is overfed to obtain a speed corresponding to the winding speed.

[0030] In the invention, the feed roller has the same structure in a configuration and a dimension as that of the rotational roller to be the tension relieving unit of the thread breakage preventing apparatus, and both rollers are coupled through the same shaft and are driven at the same time. The rotating speed of the rotational roller provided between the thread feeding portion and the yarn introducing portion of the twisting spindle is caused to be coincident with the rotating speed of the feed roller provided between the balloon guide for more increasing the feeding amount than the winding speed of the twine winding portion and the twine winding portion. Consequently, also when the abnormal tension acts on the original thread, the feeding amount of the yarn fed to the twisting spindle is set to be at least larger than the winding speed of the twine winding portion to guarantee stable ballooning.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] FIG. 1 is an explanatory view schematically showing an example of a structure of a thread plying machine including a thread breakage preventing apparatus according to a first embodiment of the invention and a thread plying step.

[0032] FIG. 2 is a partial enlarged perspective view showing an example of the arrangement of the components of the thread breakage preventing apparatus according to the first embodiment.

[0033] FIG. 3 is a partial sectional view schematically showing the structure of the peripheral surface of a rotational roller to be a component of the thread breakage preventing apparatus.

[0034] FIG. 4 is a partial enlarged perspective view showing an example of the arrangement of the components of a thread breakage preventing apparatus according to a second embodiment of the invention.

[0035] FIG. 5 is an explanatory view schematically showing an example of a typical structure of a conventional thread plying machine and a thread plying step.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] A preferred embodiment of the invention will be specifically described below with reference to the drawings. FIG. 1 schematically shows the thread plying step of a thread plying machine referred to as a cable twister which includes a thread breakage preventing apparatus according to a first embodiment of the invention.

[0037] The reference numeral 1 shown in FIG. 1 denotes a first thread feeding pin provided over a creel which is not shown. A large number of thread feeding pins 1 are provided over the creel, and a first original thread Y1 (yarn) formed by a multifilament is led out by a vertical taking method. In the embodiment, the thread feeding pin 1 has a great weight of 3 kg (a thread length of approximately 180,000 m) and a large size.

[0038] The first original thread Y1 led out of the thread feeding pin 1 enters thread breakage preventing apparatuses 3 and 4 according to the invention through a spring tenser 2, passes through the thread breakage preventing apparatuses 3 and 4 and is guided from a yarn lead-in port (not shown) of a spindle pot 6a of a twisting spindle 6 into the pot 6a through a ball tenser 5, and is led out of a thread lead-out port formed in the side portion of the spindle pot 6a to the outside. The spindle pot 6a is formed to take the shape of an inverted cone and a second thread feeding pin 7 for a second original thread Y2 (yarn) is fitted in the pot 6a from above. The thread feeding pin 7 has a lighter weight than the weight of the first thread feeding pin 1 and a whole thread length is usually set to be small.

[0039] A balloon guide 8 is provided just above the second thread feeding pin 7 and the first original thread Y1 led from the side portion of the spindle pot 6a is inserted through the balloon guide 8. On the other hand, the second original thread Y2 wound upon the second thread feeding pin 7 fitted in the spindle pot 6a is also inserted directly through the balloon guide 8 together with the first original thread 1. When the twisting spindle 6 is rotated, the first original thread Y1 is rotated around the second thread feeding pin 7 while forming a balloon between the yarn lead-out port of the spindle pot 6a and the balloon guide 8 and two original threads T1 and T2 are plied into one in the balloon guide 8 portion. A twine Y3 thus obtained is overfed to a winding portion 10 through a feed roller 9 and is wound upon a paper tube (a plastic tube, an aluminum tube) through the winding portion 10 so as to be a cheese 11.

[0040] This embodiment is characterized by the thread breakage preventing apparatuses 3 and 4 as a tension relieving unit and the feed roller 9. FIG. 2 is an enlarged view

showing an example of a schematic structure of the thread breakage preventing apparatuses 3 and 4 and the related structure of the thread breakage preventing apparatuses 3 and 4 and the feed roller 9.

[0041] The thread breakage preventing apparatus according to the embodiment is constituted by a rotational roller 3 and a guide roller 4 to be simply rotated freely as shown in FIGS. 1 and 2.

[0042] As shown in FIG. 3, the rotational roller 3 has a first groove portion 3a having an almost U-shaped section which is formed on a peripheral surface thereof in a circumferential direction, and a second groove portion 3b having a V-shaped section which is formed along the bottom part of the first groove portion 3a in the same circumferential direction. Moreover, an elastic layer 3c constituted by an elastic material formed of urethane rubber or silicon rubber having a predetermined hardness is formed over the whole surfaces of the first groove portion 3a and the second groove portion 3b. Furthermore, bulged portions 3d having triangular sections which take, as one side, the extended surface of the bottom face of the first groove portion 3a are opposed with respective extended ends close to each other along opposed ridge portions to be the intersecting portions of the first groove portion 3a and the second groove portion 3b in the elastic layer 3c.

[0043] The first original thread Y1 fed through the spring tenser 2 is laid over almost the lower half circumference of the rotational roller 3 having the structure described above, and is then laid like a zigzag over the upper half of the peripheral surface of the guide roller 4 or more and is sent to the ball tenser 5 provided below and is thereafter introduced into the twisting spindle 6 through the ball tenser 5. In the case in which a tension stationarily fluctuates in the first original thread Y1, is the first original thread Y1 is supported on the elastic layer of the first groove portion 3a of the rotational roller 3 by pressure contact force corresponding to the fluctuation in the tension and is sent to the downstream side while changing a degree of slip corresponding to the pressure contact force.

[0044] If the first original thread Y1 on the first thread feeding pin 1 has a fuzz, for example, and is tangled with the adjacent original thread Y1 and is not led out smoothly with a normal taking tension, a tension is rapidly increased between a thread feeding portion and the rotational roller 3. According to the embodiment, the pressure contact force of the first original thread 1 against the peripheral surface of the rotational roller 3 is also increased by the rapid increase in the tension. When the pressure contact force exceeds the support force of the bulged portion 3d in the bottom part of the first groove portion 3a formed on the peripheral surface of the rotational roller 3, the bulged end of the bulged portion 3d is elastically deformed in the direction of a roller center so that the first original thread Y1 slides into the second groove portion 3b having a V-shaped section.

[0045] As a result, the first original thread Y1 is strongly gripped by the second groove portion 3b, and the tanglement of the first original thread Y1 in the thread pin 1 is instantaneously released by rotating force and the first original thread Y1 is reliably sent to the downstream side. Consequently, an abnormal tension is not propagated to the yarn introducing portion of the twisting spindle 6 on the downstream side and the diameter of a balloon can be

prevented from being reduced due to the abnormal tension. Thus, a thread breakage can be prevented reliably. The tanglement of the first original thread Y1 is released as described above, and at the same time, the tension of the first original thread Y1 is instantaneously returned into a stationary state. Therefore, the first original thread Y1 is guided by the bulged portion 3d with only a strain generated by a tension in the stationary state, and is automatically returned to the surface of the elastic layer of the first groove portion 3a again.

[0046] In other words, according to the embodiment, the rotational roller contacts the yarn by pressure, and the pressure contact force of the yarn against the peripheral surface of the rotational roller is increased by gripping the yarn when the tension of the yarn exceeds a predetermined value.

[0047] In the embodiment, moreover, the rotating speed of the feed roller 9 provided between the balloon guide 8 and the winding portion 10 is caused to be slightly higher than the winding speed of the winding portion 10 to overfeed the twine Y3. Usually, the winding tension of the winding portion 10 is increased by an increase in the tension caused by a shrinkage due to the plying with the ballooning of the first original thread Y1 so that a set winding tension is exceeded. Consequently, the cheese 1 is wound hard. In order to avoid this situation, the twine Y3 is overfed by the feed roller 9 to decrease the tension of the twine fed to the winding portion 10. Thus, the cheese 11 having a set winding hardness is manufactured.

[0048] In the embodiment, moreover, the feed roller 9 provided between the balloon guide 8 and the winding portion 10 and the rotational roller 3 are supported on the same rotating shaft 12 as described above. Furthermore, the feed roller 9 has the same roller structure in a construction and a dimension as the rotational roller 3, and both of the rollers 3 and 9 are rotated at the same rotating speed. By such a structure, also when an abnormal tension state is brought, the feeding amount of the first original thread Y1 by the rotational roller 3 approximates to the winding amount of the twine Y3. Consequently, it is possible to avoid an increase in the tension for the balloon formed by the twisting spindle 6.

[0049] FIG. 4 schematically shows a second embodiment of the thread breakage preventing apparatus according to the invention.

[0050] According to this embodiment, the thread breakage preventing apparatus as a tension relieving unit is constituted by a rotational roller 3 and a guide roller 4, which have the same structures as those in the first embodiment, and a leaf spring 13. In the embodiment, the leaf spring 13 and the guide roller 4 are provided in such a manner that a first original thread Y1 led from a thread feeding portion which is not shown runs to simply come in contact with the rotational roller 3 during a stationary operation as shown in a solid line of FIG. 4.

[0051] More specifically, the first original thread Y1 led from the thread feeding portion is first inserted through an insertion hole 13a formed on the free end of the leaf spring 13 and is laid over the guide roller 4 almost horizontally, and is taken downward. In a stationary tension state, the peripheral surface of the rotational roller 3 is simply provided to

come in contact with the first original thread Y1 running rectilinearly from the leaf spring 13 toward the guide roller 4 and does not positively send the original thread Y1.

[0052] When a tension fluctuation is caused within such a range that a thread breakage is not generated on the first original thread Y1 and a greater tension than a stationary tension is particularly generated, the first original thread is strained corresponding to an increase in the tension and the leaf spring 13 is elastically deformed in a direction shown in an arrow of FIG. 4, thereby causing the first original thread Y1 running between the leaf spring 13 and the guide roller 4 to come in contact with the peripheral surface of the rotational roller which is driven and rotated. According to the pressure contact force, the first original thread Y1 is positively fed toward the downward side while a slip amount is caused to fluctuate over the peripheral surface of the rotational roller 3 in the same manner as in the first embodiment.

[0053] When some drawback is generated on the thread feeding portion side so that the tension of the first original thread Y1 is further increased, the leaf spring 13 is greatly deformed elastically to push the first original thread Y1 against the peripheral surface of the rotational roller 3 by the pressure contact force and to slide the first original thread Y1 into the V-shaped groove portion 3b shown in FIG. 3 so that grip force for the original thread Y1 is increased to strongly lead out the original thread Y1 on the thread feeding portion side, resulting in the elimination of the drawback. At the same time, the original thread Y1 is positively fed to the downstream side in a feeding amount corresponding to the rotating speed of the rotational roller 3 which is driven and rotated. The drawback of the first original thread Y1 is eliminated, and at the same time, the first original thread Y1 is returned to have the stationary tension. Consequently, the first original thread Y1 is pulled out of the V-shaped groove portion 3b of the peripheral surface of the rotational roller 3 by the elastic force of the leaf spring 13 and is returned into such a stationary state as to come in contact with the peripheral surface of the rotational roller 3. In the meantime, this operation is carried out instantaneously. Therefore, the abnormal tension generated in the first original thread Y1 on the thread feeding portion side is not propagated to a yarn processing portion such as a twisting spindle (not shown) on the downstream side. Consequently, the generation of a thread breakage can be prevented reliably.

[0054] While the structure of the rotational roller 3 has been described above by taking an example of the structure of the peripheral surface in FIG. 3, the structure of the roller is not restricted to an example shown in the drawing but can be changed variously. In brief, the amount of positive feed can be changed based on a fluctuation in the tension of a yarn coming in contact with the peripheral surface. Furthermore, when such an abnormal tension as to cause a thread breakage is generated in the processing portion, it is preferable to employ a structure in which the yarn can be positively fed in a feeding amount corresponding to the overfeed amount of the feed roller in the winding portion.

[0055] Table 1 shows a result of a state in which a thread breakage is generated by a fluctuation in the thread feeding tension of the first original thread Y1 using a cable twister provided with the thread breakage preventing apparatus (tension relieving unit) according to the invention shown in

FIG. 1 and the conventional cable twister shown in FIG. 5. Incidentally, a pin cover means a tubular cover covering the surrounding of the second thread feeding pin 7.

TABLE 1

Tension Relieving Unit	Pin Cover	T-0	T-1	T-2	T-3	Unit: g Thread break- age
○	○	0.2	6	3	4	—
		10 ± 2	15 ± 1	6-7	9.5-9.8	—
		20 ± 5	28 ± 2	10	14	—
		30 ± 5	40 ± 5	13.8-14.3	21-22	—
		40 ± 10	45 ± 10	17-22	28-32	—
X	○	—	—	—	70-	Yes
		0.2	6-7	—	11	—
		40 ± 10	—	—	—	Yes
		—	—	—	70-	Yes

[0056] As is understood from the Table 1, the conventional cable twister does not comprise the thread breakage preventing apparatus according to the invention. Therefore, a thread feeding tension T-0 applied from the thread feeding pin 1 is greatly increased to a tension T-3 after passing through a ball tenser 5. On the other hand, in the cable twister according to the invention, the thread feeding tension T-0 applied from the thread feeding pin 1 is temporarily increased to a tension T-1 between a spring tenser 2 and the rotational roller 3 and is greatly decreased (T-2) before entering the ball tenser 5. A tension T-3 of the first original thread Y1 passing through the ball tenser 5 is slightly increased. Consequently, it is apparent that a thread breakage is not generated till the thread feeding tension T-0 of 40±10 (g) and is not generated till the final tension T-3 of approximately 70 (g) in the cable twister according to the invention. However, the thread breakage is generated with the thread feeding tension T-0 of 25 to 30 (g) in the conventional cable twister.

What is claimed is:

1. A thread breakage preventing apparatus comprising:
a tension relieving unit disposed on a running path of a yarn and serving to positively feed the yarn to a downstream side in a feeding amount corresponding to a tension of the yarn when the tension exceeds a preset tension.
2. The thread breakage preventing apparatus according to claim 1,
wherein the tension relieving unit includes a rotational roller to be rotated at a constant rotating speed, the rotational roller including a yarn feeding amount increasing and decreasing portion for instantaneously increasing and decreasing the feeding amount of the yarn based on a behavior of the yarn corresponding to an increase and decrease in the tension of the yarn.
3. The thread breakage preventing apparatus according to claim 2,
wherein the yarn feeding amount increasing and decreasing portion includes a taking and feeding structure for

- leading out the yarn against a fluctuation in the tension when an abnormal tension of the yarn is generated and for instantaneously feeding the yarn in a necessary feeding amount to a downstream side.
4. The thread breakage preventing apparatus according to claim 1,
wherein the tension relieving unit includes a rotational roller contacting the yarn by pressure, and a pressure contact force of the yarn against the rotational roller is increased by gripping the yarn when a tension of the yarn exceeds a predetermined value.
5. The thread breakage preventing apparatus according to claim 1,
wherein the tension relieving unit includes a rotational roller and a guide roller, and the yarn is laid like a zigzag over the rotational roller and the guide roller.
6. A yarn processing machine comprising:
a thread feeding portion;
a tension relieving unit disposed on a running path of a yarn and serving to positively feed the yarn to a downstream side in a feeding amount corresponding to a tension of the yarn when the tension exceeds a preset tension; and
a yarn processing portion,
wherein the tension relieving unit is provided on the running path between the thread feeding portion and the yarn processing portion.
7. The yarn processing machine according to claim 6,
wherein the yarn processing portion is a twisting spindle.
8. A thread plying machine comprising:
a thread feeding portion;
a tension relieving unit disposed on a running path of a yarn and serving to positively feed the yarn to a downstream side in a feeding amount corresponding to a tension of the yarn when the tension exceeds a preset tension; and
a yarn processing portion; and
a feed roller; and
a twine winding portion,
wherein the tension relieving unit is provided on the running path between the thread feeding portion and the yarn processing portion, and
wherein the feed roller is provided between the yarn processing portion and the twine winding portion and serving to overfeed a twine to the twine winding portion.
9. The thread plying machine according to claim 8,
wherein the tension relieving unit is a rotational roller to be rotated at a predetermined rotating speed, and the feed roller has the same structure as a structure of the rotational roller, and the rotational roller and the feed roller are supported on an identical rotating shaft.

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