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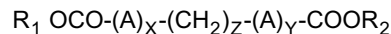
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(54) **POLYESTER FIBER FOR FALSE TWISTING**

(57) The polytrimethylene terephthalate-based polyester yarn, which has excellent smoothness, heat resistance, collectability and anti-electricity, scarcely generates fluffs and broken yarn, and can stably be subjected to false-twisting, is a polyester yarn whose 80 % or more by weight is formed from polytrimethylene terephthalate, which has a birefringence of 0.03 to 0.08, an elongation of 30 to 180%, an elastic recovery of 30 to 100% at 10% elongation, and to whose surface a treating agent, containing an ether-ester compound (the component a) represented by the following formula in an amount of 50 to 80 % by weight and a polyether compound (the component b) having a molecular weight of

10,000 or more in an amount of 2 to 20 % by weight, is stuck in an amount of 0.2 to 1.0 % by weight.



[wherein, R_1 and R_2 are each an alkyl group having 7 to 21 carbon atoms, A is an oxyalkylene group having 2 to 4 carbon atoms, X and Y are each an integer of not less than 0, provided that (X + Y) is an integer of 1 to 20, and Z is an integer of 3 to 12].

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Description

Technical Field

[0001] The present invention relates to a polytrimethylene terephthalate-based polyester yarn having an excellent false-twisting property. In more detail, the present invention relates to a polytrimethylene terephthalate-based polyester yarn which has excellent smoothness, heat resistance, collectability and anti-electricity, scarcely generates fluffs and yarn breakage, and can stably be subjected to false-twisting.

Background Art

[0002] Since the polyester yarns comprising polytrimethylene terephthalate have low elastic modulus, a knitted or woven fabric obtained from the yarns not only exhibits a soft hand-touch but also has the same elastic recovery and dyeability as those of polyamide yarns, and further maintains the characteristics of polyester yarns comprising polyethylene terephthalate, such as dimensional stability, light resistance and low hygroscopicity. The development of the polyester yarns comprising the polytrimethylene terephthalate in wide fields is thereby expected.

[0003] Most of yarns usually used for the uses of clothes have the forms subjected to some bulking treatments and, among them, bulky yarns subjected to false-twisting are generally used. This false-twisting method has been improved from a conventional spindle method to a frictional false-twisting method (hereinafter often referred to a friction method), and the processing speed has rapidly been enhanced. Furthermore, in the friction method, the false-twisting at extremely high speeds of 800 m/minute to 1,200 m/minute is recently generally carried out due to the advance of various machines.

[0004] On the other hand, while generally a partially oriented yarn (hereinafter often referred to as POY), as a raw yarn for applying the frictional false-twisting, produced at a spinning speed of 3,000 m / minute or more is applied with a drawing treatment and simultaneously a frictional false-twisting (hereinafter this method is often referred to as DTY) from the viewpoint of the improvement in productivity, some false-twisting methods, such as a method (hereinafter often preferred to as PTY) for applying a frictional false-twisting to a drawn yarn obtained by continuously performing a spinning and a drawing treatment at a high speed (hereinafter often referred to as direct drawing) or a method for applying a frictional false-twisting to an oriented yarn (hereinafter often preferred to as USY) produced at a spinning speed of 5,000 m / minute or more, have been proposed.

[0005] However, these methods all aim to lower the production costs for the yarns by the improvement of productivity, and when the production of the yarns and their false-twisting are carried out under those conditions, the yarns are very often exposed to more and more severe conditions due to, for example, the increase in the contact pressures of the yarns with various contact members (guides, rollers, heaters and the like) and the rise of thermal treatment temperature accompanied with the increase of processing speeds. The frictions of the yarns with the various contact members are remarkably increased, for example, according to the increase of the processing speeds with the result that the generation of white powder, fluffs, broken yarns, and so on due to the damages of the yarns is consequently increased and the processability of the yarns is lowered. In addition, as a phenomenon remarkably appearing due to the high speed processing, a large centrifugal force acts on the yarn, because the false-twisting speed is also naturally increased in response to the high speed processing. Hence, a general conventional treating agent is often squeezed and shaken off from the surface of the yarn and flies largely on a heater. Consequently, the heater is considerably stained, and in an extreme case, an inconvenient phenomenon in which the treating agent flows down along the groove of the heater, namely 'tar flows', is caused. When the tar is produced on the heater, the passing property of the yarn is extremely lowered, thereby the fluffs or abnormal crimps on the obtained processed yarn tend to generate and the yarn results in the breakage in an extreme case. Accordingly, the heater must frequently be cleaned to dissolve the inconvenience, but the frequent cleaning treatments of the heater adversely lowers the productivity of the yarn, thus finally resulting in the increase of the production cost. When the polyester yarn comprising the polytrimethylene terephthalate is subjected to the false-twisting, an additional large problem is that the passing property of the yarn is further deteriorated to make the high speed processing of the yarn difficult, because the yarn is easily deformed even under a low tension to increase the contact areas of the yarn with various contact members, thereby increasing the static frictions between the yarn and the various contact members in comparison with those of a polyester yarn comprising polyethylene terephthalate.

[0006] According to our researches, it was turned out that the characteristic problem of the polytrimethylene terephthalate yarn, namely the passing property of the yarn, could not be improved, even when a treating agent containing as a main component polyethers, having generally been used for polyethylene terephthalate yarns, was used, because the static frictions between the yarn and the various contact members were still high. In order to solve the problem, a method for using a polyether having a molecular weight of 10,000 to 20,000 in an amount of 1 to 20 % by weight, as one of polyethers in a treating agent containing said polyethers

as the main components, thereby lowering the static frictions between the yarn and the yarn to control the breakage of the yarn, is proposed in Japanese Unexamined Patent Publication (Kokai) 11-229276 (1999). When the high molecular weight polyether having the molecular weight of 10,000 to 20,000 is together used, it may surely be expected that the static frictions between the yarn and the yarn is reduced to control the yarn breakage caused by the friction of the yarns, but the level is still insufficient. Additionally, since the treating agent containing the polyethers as the main components gives high dynamic frictions between the yarn and the various contact members and together contains the high molecular weight polyether having a high viscosity, the dynamic frictions between the yarn and the various contact members are further increased. It is therefore difficult to control the generation of fluffs and broken yarns, and it is impossible to improve the passing property of the yarn when the yarn is subjected to frictional false-twisting.

[0007] It may be considered that the addition of a mineral oil or an ester to the treating agent containing the polyethers as the main components is effective as a means for reducing the dynamic frictions between the yarn and the various contact members, but the treating agent is liable to increase the generation of heater-tars and flied oil drops because of forming a large amount of heated residues. Therefore, a practically satisfactory treating agent has really not been proposed yet.

Disclosure of the Invention

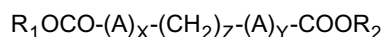
[0008] The object of the present invention is to provide a polytrimethylene terephthalate-based polyester yarn which has excellent smoothness, heat resistance, collectability and anti-electricity, scarcely generates fluffs and broken yarn, and can stably be subjected to false-twisting.

[0009] The present inventors have found that it has been effective for achieving the object to use the combination of the specific ether-ester compound with the polyether compound as the treating agent, which has led to the completion of the present invention.

[0010] Namely, the polyester yarn of the present invention, capable of achieving the object and used for false-twisting, characterized in that 80 % or more by weight of the polymer component constituting the yarn comprises trimethylene terephthalate units, in that said yarn has a birefringence of 0.03 to 0.08, an elongation of 30 to 180 %, and an elastic recovery of 30 to 100 % at 10 % elongation, and in that a treating agent containing the following components a and b is stuck to the surface of said yarn in an amount of 0.2 to 1.0 % by weight based on the weight of the yarn.

[0011] The components of the treating agent and contents thereof;

- a. An ether-ester compound represented by the following general formula : a content of 50 to 80 % by weight;



[wherein, R_1 and R_2 are each an alkyl group having 7 to 21 carbon atoms, A is an oxyalkylene group having 2 to 4 carbon atoms, X and Y are each an integer of not less than 0, provided that $(X + Y)$ is an integer of 1 to 20, and Z is an integer of 3 to 12].

- b. A polyether compound having a molecular weight of 10,000 or more : a content of 2 to 20 % by weight.

Best Mode for Carrying Out the Invention

[0012] As to the polyester yarn of the present invention, 80 % or more by weight of the polyester is comprised of the polytrimethylene terephthalate, but the polyester may be copolymerized with the third component within a range (usually 20 % or less by weight) not damaging the object of the present invention. The third component, as copolymerization components, includes acid components such as adipic acid, sebacic acid, isophthalic acid, 5-sodium sulfoisophthalic acid, 2,6-naphthalene dicarboxylic acid and cyclohexane dicarboxylic acid, and diol components such as ethyleneglycol, tetramethyleneglycol, cyclohexanedimethanol and polyethyleneglycol. The polyester may be blended with other polyesters such as polyethylene terephthalate, polytetramethylene terephthalate, polycyclohexanedimethylene terephthalate and polyethylene 2,6-naphthalenedicarboxylate. If necessary, a delustering agent, a thermal stabilizer, an ultraviolet light absorbent, an antistatic agent, a terminator, a fluorescent brightening agent, and so on, may further be added.

[0013] The intrinsic viscosity (measured in ortho-chlorophenol as a solvent at a temperature of 35°C) of the polytrimethylene terephthalate-based polyester is suitably in the range of 0.4 to 2.0, preferably in the range of 0.5 to 1.5, further preferably in the range of 0.6 to 1.2, from the viewpoint of stability on spinning and from the viewpoint of the dynamic characteristics (strength, elongation, and so on) of the obtained yarn.

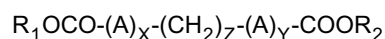
[0014] The polyester yarn of the present invention is a yarn comprising the above-mentioned polytrimethylene terephthalate-based polyester, and it is important to satisfy the following characteristics and to be stuck with the later-described

specific treating agent to the surface of the yarn so that the polyester yarn has excellent smoothness, heat resistance, collectability and anti-electricity and also has capability of being stably false-twisted substantially without generating fluffs and a broken yarn.

[0015] Namely, as the first one of the characteristics of the polyester yarn, it is necessary that the birefringence of the yarn is in the range of 0.03 to 0.08. The yarn having the birefringence in this range is usually called a partially oriented yarn (often referred to as POY). The birefringence of less than 0.03 is undesirable, because the quality irregularity of the yarn is liable to be caused by the generation of the change in the physical properties of the raw yarn with the passage of time before subjected to false-twisting, the partial fusion of the yarn on the false-twisting process and so on. On the other hand, the birefringence of more than 0.08 is also undesirable, because the yarn, has the physical properties close to those of a drawn yarn, is liable to be fluffed or broken, when false-twisted at a high speed, and can thereby not be false-twisted stably. As the second characteristic, it is necessary that the elongation is in the range of 30 to 180 %, preferably in the range of 60 to 150 %. The elongation except the above range is not desirable, because the yarn tends to be broken or fluffed on the false-twisting and can stably not be processed. As the third characteristic, it is needed that the elastic recovery at 10 % elongation is 30 to 100 %, preferably 50 to 80 %. Said elastic recovery excluding the above range is not desirable, because the yarn does not give a knitted or woven fabric having a soft hand-touch, after processed.

[0016] Further, it is necessary that a treating agent containing an ether-ester compound (component a) represented by the following general formula and a polyether compound (component b) having a molecular weight of 10,000 or more, preferably 20,000 to 100,000, further preferably 20,000 to 50,000, is stuck to the surface of the polyester yarn having the above-mentioned physical properties.

[0017] The component a :



wherein, R_1 and R_2 are each an alkyl group having 7 to 21 carbon atoms, A is an oxyalkylene group having 2 to 4 carbon atoms, X and Y are each an integer of not less than 0, provided that $(X + Y)$ is an integer of 1 to 20, and Z is an integer of 3 to 12.

[0018] The ether-ester compound represented by the above-mentioned formula is a component for controlling the generation of heater-tars on the false-twisting and adjusting the dynamic frictions between the yarn and various contact members to improve handling properties such as a threading property. The component is synthesized by addition-reacting 1 to 20 moles of an alkyleneoxide having 2 to 4 carbon atoms to a known linear saturated glycol having 3 to 12 carbon atoms in a random or block state and then esterifying the reaction product with an aliphatic carboxylic acid. Said linear saturated glycol having the 3 to 12 carbon atoms concretely includes 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,7-heptanediol, 1,8-octanediol, 1,10-decanediol, and 1,12-dodecanediol. 1,4-butanediol, 1,5-pentanediol or 1,6-hexanediol is preferable. As the alkyleneoxide having 2 to 4 carbon atoms, ethyleneoxide, propyleneoxide and butyleneoxide may be exemplified, and they may singly or together be used. The addition mole number $(X + Y)$ of the alkyleneoxide is necessary to be 20 or less, especially preferably 10 or less, because the viscosity of the ether-ester compound is increased to lower the smoothness, when the $(X + Y)$ is too large. Furthermore, the aliphatic carboxylic acid used for the esterification is necessary to be an aliphatic carboxylic acid having 8 to 22 carbon atoms (the carbon atom number of the alkyl group in the formula is 7 to 21), and concretely includes linear saturated aliphatic carboxylic acids such as caprylic acid, pelargonic acid, capric acid, undecanoic acid, lauric acid, tridecanoic acid, myristic acid, pentadecanoic acid, palmitic acid and stearic acid, and normal unsaturated aliphatic carboxylic acids such as obtusilic acid, zoomaric acid and oleic acid. Aliphatic carboxylic acids having the carbon atom numbers of less than 8 are not desirable, because they have insufficient heat resistance and are liable to fume on a heater on false-twisting. On the other hand, aliphatic carboxylic acids having carbon atom numbers exceeding 22 are also not desirable, because the smoothness becomes insufficient.

[0019] It is necessary that the content of the ether-ester compound (component a) in the treating agent is in the range of 50 to 80 % by weight, preferably 60 to 80 % by weight. When the content is less than 50 % by weight, the object of the present invention can not be achieved, because the smoothness becomes insufficient. On the other hand, the content exceeding 80 % by weight is also not desirable, because the amount of an emulsifier capable of being used for emulsifying said ether-ester compound is decreased to lower the stability of said treating agent.

[0020] The polyether compound (component b) having a molecular weight of 10,000 or more, which is together used with the above-mentioned ether-ester compound (component a), is a component for adjusting the static frictions between the yarn and the yarn to improve the fluff resistance of the yarns even with a relative small amount. The component b having a molecular weight of 10,000 to 20,000 can be produced by a method of anionically polymerizing a conventional alkylene oxide, but the component b having a molecular weight exceeding 20,000 is generally produced by a coordinated anionic polymerization method. Since the polyether compound produced by this method has a larger

molecular weight than those of polyether compounds produced by the conventional general anionic polymerization method, an effect for improving the fluff resistance is extremely large. Further, while the polyether compound produced by the anionic polymerization method has a wide molecular weight distribution, the polyether compound produced by the coordinated anionic polymerization method has a narrow molecular weight distribution and therefore it is remarkably effective for improving the fluff resistance because of being easier to adjust the static frictions between the yarn and the yarn.

[0021] The polyether compound produced by the coordinated anionic polymerization method is usually ethylene oxide-propylene oxide copolymer, and the molecular weight of the copolymer is preferably in the range of 20,000 to 100,000 because of being easily produced, but the molecular weight of about 20,000 to about 50,000 is more preferable from the viewpoint of handling property. The copolymerization weight ratio (PO / EO) of the propylene oxide (PO) to the ethylene oxide (EO) is suitably in the range of 20 / 80 to 50 / 50. Of course, one terminal or both terminals of the copolymer may be blocked with alkyl groups, acyl groups, or the like through ether bonds, ester bonds, or the like.

[0022] The content of the polyether compound (component b) having a molecular weight of 10,000 or more in the treating agent is necessary to be 2 % or more by weight for preventing the generation of fluffs on false-twisting, but it is necessary that the content is 20 % or less by weight, preferably 5 to 20 % by weight, because the too large content of the polyether compound deteriorates the smoothness due to the increase in the viscosity of the treating agent, lowers the stability of the process on the production of the yarn, and further reduces the static frictions between the yarn and the yarn to cause a problem on a winding property.

[0023] The above-explained treating agent used in the present invention may be mixed with a conventional nonionic surfactant, a conventional anionic surfactant, a conventional silicone compound, a conventional fluoro-compound, a conventional antioxidant, and so on, within ranges not interrupting the object of the present invention, in addition to the above-mentioned components. For example, as the nonionic surfactant, polyalkylene glycol alkyl ethers, polyalkylene glycol aryl ethers, partially esterified polyhydric alcohol-alkylene oxide adducts, and the like are exemplified and they are used for improving the emulsifiability of the ether-ester compound and the wettability of the yarn. Among them, especially, the polyalkylene glycol alkyl ethers can be preferably used. Also, the anionic surfactant is used for improving the anti-electricity, and alkylsulfonate salts, alkylphosphate salts, polyalkylene glycol alkyl ether sulfonate salts, alkylcarboxylate salts, alkylsulfate salts, and the like are concretely exemplified.

[0024] The method for sticking the treating agent to the surface of the polyester yarn is especially not limited, but is usually a method for vesting the treating agent to a melt-spun undrawn yarn and, if necessary, then subjecting the treated undrawn yarn to a drawing treatment. The method for vesting the treating agent to the undrawn yarn is also arbitrary, but the treating agent is usually vested in the form of an aqueous emulsion having a concentration of 3 to 20 % by weight by a conventional known method such as an oiling roller method or a nozzle method.

[0025] It is necessary that the amount (as the active ingredient of the treating agent) of the treating agent to be vested to the polyester yarn is in the range of 0.2 to 1.0 % by weight, preferably in the range of 0.3 to 0.5 % by weight, based on the weight of the yarn. Said vesting amount exceeding 1.0 % by weight is not desirable, because tars are adhered to a heater plate on the frictional false-twisting of the obtained yarn, thereby making it impossible to stably false-twist the yarn, although a problem is especially not caused on the windability of the yarn on the spinning. On the other hand, the vesting amount of less than 0.2 % by weight is also not desirable, because the collectability and lubricity of the yarn become insufficient and therefore the windability of the yarn on the spinning is deteriorated and the processability of the yarn on the frictional false-twisting become insufficient.

[0026] The above-explained polyester yarn of the present invention can be false-twisted by any one of conventional known methods, but urethane or ceramic disks or belts are generally used as a tool for the frictional false-twisting. Any one of a contact one step method, a contact-noncontact two step method, and a noncontact two step method can be adopted for the heater of a false-twisting machine in response to a crimp state and a processing speed to be demanded. In addition, the temperature of the heater is suitable at 170 to 200°C in the case of a contact heater, and at 170 to 500°C in the case of a non-contact heater. The processing speed is suitably selected within the range of 300 to 1,200 m / minute in response to the model of the processing machine.

[0027] The processed yarn obtained by applying the false-twisting is usually woven or knitted into the woven or knitted fabric. At that time, the yarn may, if necessary, additionally oiled with 0.3 to 3 % by weight of a treating agent consisting mainly of a mineral oil or ester compound having a low viscosity to further impart smoothness to the yarn.

Examples

[0028] The present invention will concretely be explained hereafter in more detail with examples. Therein, evaluation items in the examples were conformed to the following methods.

(1) Birefringence (Δn)

[0029] The birefringence is measured by a conventional method, measuring interference fringes with monochromatic light having a wavelength of 530 nm by the use of a polarization microscope in 1-bromonaphthalene as a penetrating liquid.

(2) Elastic recovery at 10% elongation

[0030] The elastic recovery at 10% elongation is obtained, by attaching a sample yarn to a tensile tester at a distance of 250 mm between chucks, by elongating the attached sample yarn up to an elongation ratio of 10% at a tensile speed of 50 mm/minute and leaving the elongated sample yarn for one minute, subsequently by returning the length of the sample yarn to the original length of the sample yarn at the same speed of 50 mm/minute as the tensile speed, by reading the movement distance (L' mm) of the chuck in the stress-applied state, and then by determining the elastic recovery according to the following equation.

$$\text{Elastic recovery (\%)} = [L' / 25] \times 100$$

(3) Oil pick up (OPU)

[0031] The oil pick up is obtained, by picking about 3 g of a polyester yarn sample, by drying the sample at 105°C for 2 hours, immediately by measuring the weight (A) of the sample, subsequently by immersing the sample in 300 cc of a washing aqueous solution containing a sodium alkylbenzenesulfonate as a main component, by applying ultrasonic waves to the immersed sample at 40°C at least for 10 minutes, by scrapping the washing solution, by washing the sample with 40°C hot water for 30 minutes, by drying the washed sample in air at room temperature, further by drying the sample at 105°C for 2 hours, and then immediately by measuring the weight (B) of the sample.

$$\text{OPU(\%)} = (A - B) / B \times 100.$$

(4) Static friction between the yarn and the yarn

[0032] A polyester yarn (A) of 138 dtex / 36 filaments is wound on a cylinder at a spiral angle of $\pm 15^\circ$ with a winding tension of about 9.8 cN (10g). The cylinder has a diameter of 2 inches (5.1 cm) and a length of 3 inches (7.6 cm). The same polyester yarn as mentioned above is taken in a length of 12 inches (30.5 cm) (B) and then hung on the cylinder. At that time, said component (B) is loaded on the upper layer portion of the above-mentioned component (A) and arranged in parallel to the winding direction. A load of 0.035 cN / dtex (0.04 g/de) is hung on one end of the component (B), and a strain gauge is connected to the other end. The cylinder is rotated at a circumferential speed of 0.0016 cm / second at an angle of 180 degree, and the tensions on the rotation is continuously recorded. The frictional coefficient (f) between the filaments is calculated according to the following equation.

$$f = 1/\pi \times \ln(T_2/T_1)$$

[0033] Wherein, T_2 is the average value of peak tensions ($n = 25$), T_1 is a tension given by applying a load of 0.035 cN / dtex (0.04 g/de) to the multi-filaments, and $\ln$ is a natural logarithmic symbol. Therein, the data of samples irreversibly elongated, namely drawn, during the measurement are not used. And the temperature of the measurement atmosphere is 25°C.

(5) Dynamic friction between the yarn and the metal contact member

[0034] The frictional coefficient is obtained, by taking a polytrimethylene terephthalate yarn comprising 83 dtex / 36 filaments as a sample, by measuring the tension (T_2) of the sample on the exit side of a frictional member comprising a 60 mm diameter satin chromium pin by the use of a machine for measuring the friction between the yarn and the metal at a travel speed of 300 m / minute at a contact angle of 180 degree at a tension of 9.8 cN (10g : T_1) on the entrance side of the frictional member, and then by similarly determining the frictional coefficient according to the equation used for the calculation of the static friction between the yarn and the yarn.

(6) Stability of the emulsion

[0035] The stability of the emulsion is judged, by allowing a 10% aqueous emulsion to stand at 30°C for one day, by visually observing the state of the emulsion, and then by classifying the state into three ranks consisting of a good rank (not changed), an acceptable rank (creaming-generated) and an improper rank (separated).

(7) Package shape (Bulge)

[0036] The bulge is determined by measuring the swollen width of the end face by the unit of mm on the basis of the original winding width of a package having a winding amount of 8 Kg.

(8) Fluff number, fluffs / m

[0037] The number of the fluffs per meter is determined by counting the fluffs on a 25m false-twisted yarn.

(9) Generation state of scum on the heater

[0038] The generation state of scum on the heater is judged into the 1st class to the 5th class by using the heater for the processing for 3 weeks and then by visually observing the amount of the scum generated on the heater in the 1st class (improper) to the 5th class (good).

(10) Generation state of fume on the heater

[0039] The generation state of fume on the heater is judged into the 1st class to the 5th class by visually observing the amount of the fume generated on the exit side of the heater in the first class (improper) to the fifth class (good).

[Example 1]

[0040] Polytrimethylene terephthalate having an intrinsic viscosity of 1.03 was melted and extruded from a spinneret having 36 extrusion holes each having a hole-diameter of 0.3 mm. Said extruded filaments were cooled and solidified and then taken off at a speed of 3,300 m / minute, while the aqueous emulsion (the concentration of the emulsion : 10 % by weight) of a treating agent mentioned in Table 1 was stuck in a real stuck amount of 0.35 % by weight. The obtained polyester yarn of 138 dtex / 36 filaments had a birefringence of 0.035, an elongation of 145% and an elastic recovery of 55%. The yarn was drawn and simultaneously false-twisted with a polyurethane friction disk unit equipped with a disk having a diameter of 45 mm, in a drawing ratio of 1.65, at a heater temperature of 190°C, at the number of frictional disk rotation of 6,250 rpm and at a processing speed of 800 m /minute. The results are together shown in Table 1.

Table 1

Components of the oiling agent			Experiment No.								
			1	2	3	4	5	6	7	8	9
			Examples			Comparative Examples					
#1	Ether-ester	1-1	70		70	40		70			70
		1-2		80			90			60	
		1-3							70		
	Polyether	2-1	10	6		10			10	25	
		2-2			10		6				
		2-3						10			
	Others	3-1	10	10	10	40		10	10	5	20
		3-2	6		6	6		6	6	6	6
		3-3	2	2	2	2	2	2	2	2	2
		3-4	2	2	2	2	2	2	2	2	2
# 2			good	good	good	good	# 9	good	good	good	good
# 3			0.296	0.315	0.288	0.298	0.306	0.337	0.292	0.273	0.352
# 4			0.284	0.292	0.302	0.345	0.281	0.294	0.274	0.321	0.292
# 5			4.8	4.2	4.8	4.5	4.9	4.4	4.7	6.4	4.4
# 6			0	0	0	1.0	0	0.6	0	0	2.5
#7			4	4	4	4	4	4	2	4	4
#8			4	4	4	4	4	4	2	4	4

1 : the composition of the oiling agent

2 : the stability of the emulsion

3 : the static friction between the yarn and the yarn

4 : the dynamic friction between the yarn and the metal contact member

5 : the package shape (bulge)

6 : the fluff number fluffs/m

7 : the generation state of the scum on the heater

8 : the generation state of the fume

9 : acceptable

[0041] In Table, the abbreviations of the components of the oiling agent are as follows.

1-1: (EO)₅1,6-hexanediol dilaurate1-2: (EO)₅1,4-butanediol dilaurate1-3: (EO)₅ laurylether decanoate

2-1: a random polyether having a PO/EO = 30/70 and a molecular weight of 10,000 (starting raw material: glycerol)

2-2: a random polyether having a PO/EO = 50/50 and a molecular weight of 40,000 (starting raw material: glycerol)

2-3: a random polyether having a PO/EO = 30/70 and a molecular weight of 6,000 (starting raw material: glycerol)

3-1: a random polyether having a PO/EO = 50/50 and a molecular weight of 2,000 (starting raw material: butanol)

3-2: (EO)₅(PO)₁ 2-ethylhexylether

3-3: sodium laurylsulfonate

3-4: potassium (EO)₃ laurylphosphate

Utilization in Industry

[0042] The polyester yarn comprising the polytrimethylene terephthalate is liable to increase the contact areas with

various contact members, because of tending to be deformed even under a low tension. Hence, static frictions between the yarn and the yarn and dynamic frictions between the yarn and the various contact members are larger than those of a polyester yarn comprising polyethylene terephthalate. A problem that the passing property of the yarn on a false-twisting is liable to be deteriorated to generate fluffs and broken yarn has therefore existed.

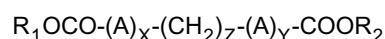
[0043] On the other hand, 0.2 to 1.0 % by weight of the treating agent, which contains such the specific ether-ester compound as mentioned above as the main component and further contains the polyether compound having a molecular weight of 10,000 or more in an amount of 2 to 20 % by weight, is stuck to the polytrimethylene terephthalate-based polyester yarn of the present invention. Therefore, the static frictions between the yarn and the yarn and simultaneously the dynamic frictions between the yarn and the various contact members are reduced, and the accumulation of tars and sludge on the heater on the false-twisting is also hardly generated. The yarn can thereby extremely stably be false-twisted at a high speed.

Claims

1. A polyester yarn for false-twisting **characterized in that** 80 % or more by weight of the polymer component constituting the yarn comprises trimethylene terephthalate units, **in that** said yarn has a birefringence of 0.03 to 0.08, an elongation of 30 to 180 %, and an elastic recovery of 30 to 100 % at 10 % elongation, and **in that** a treating agent containing the following components a and b is stuck to the surface of said yarn in an amount of 0.2 to 1.0 % by weight based on the weight of the yarn.

The components of the treating agent and contents thereof;

- a. An ether-ester compound represented by the following general formula : a content of 50 to 80 % by weight;



[wherein, R_1 and R_2 are each an alkyl group having 7 to 21 carbon atoms, A is an oxyalkylene group having 2 to 4 carbon atoms, X and Y are each an integer of not less than 0, provided that (X + Y) is an integer of 1 to 20, and Z is an integer of 3 to 12] and

- b. A polyether compound having a molecular weight of 10,000 or more : a content of 2 to 20 % by weight.

2. The polyester yarn for false-twisting according to Claim 1, wherein the molecular weight of the polyether compound is 20,000 to 50,000.

3. The polyester yarn for false-twisting according to Claim 1 or 2, wherein the polyether compound is a copolyether in which the copolymerization weight ratio (PO / EO) of propylene oxide (PO) / ethylene oxide (EO) is 20 / 80 to 50/50.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP01/02163

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ D06M15/53		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ D06M15/00-715		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2001 Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 11-229276, A (Asahi Chemical Industry Co., Ltd.), 24 August, 1999 (24.08.99) (Family: none)	1-3
Y	JP, 62-177282, A (Teijin Limited), 04 August, 1987 (04.08.87) (Family: none)	1-3
Y	JP, 53-14897, A (Asahi Chemical Industry Co., Ltd.), 09 February, 1978 (09.02.78) (Family: none)	1-3
A	WO, 99/39041, A1 (ASAHI KASEI KOGYO KK), 05 August, 1999 (05.08.99) & EP, 1052325, A	1-3
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 28 May, 2001 (28.05.01)		Date of mailing of the international search report 05 June, 2001 (05.06.01)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)