(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 488 209 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**08.01.2025 Bulletin 2025/02**

(21) Application number: **24183070.2**

(22) Date of filing: **19.06.2024**

(51) International Patent Classification (IPC):
***B65H 67/048*** *(2006.01)* ***D01D 5/088*** *(2006.01)*
***D01F 6/60*** *(2006.01)* ***B65H 54/71*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**B65H 67/048; B65H 54/71; D01D 5/0885; D01D 5/26; D01D 7/00; D01F 6/60;**
B65H 2701/3132

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA**
Designated Validation States:
**GE KH MA MD TN**

(30) Priority: **04.07.2023 CN 202310813491**

(71) Applicant: **Zhejiang Kingsway High-Tech Fiber Co., Ltd**
**Haining City 314413 (CN)**

(72) Inventors:
- **GAO, Yahui**
  **Haining City, 314413 (CN)**
- **WANG, Chenggang**
  **Haining city, 314413 (CN)**
- **CHEN, Yan**
  **Haining City, 314413 (CN)**
- **YANG, Yulong**
  **Haining CIty, 314413 (CN)**
- **QIAN, Tianyuan**
  **Haining City, 314413 (CN)**
- **LIAO, Haiqiang**
  **Haining City, 314413 (CN)**
- **JIANG, Changming**
  **Haining City, 314413 (CN)**
- **ZHANG, Jian**
  **Haining City, 314413 (CN)**
- **PAN, Jianqing**
  **Haining City, 314413 (CN)**
- **GONG, Shiguang**
  **Haining City, 314413 (CN)**

(74) Representative: **Schrell, Andreas et al**
**Gleiss Große Schrell und Partner mbB**
**Patentanwälte Rechtsanwälte**
**Leitzstrasse 45**
**70469 Stuttgart (DE)**

# (54) METHOD FOR PREPARING INDUSTRIAL NYLON FILAMENT

(57) Provided is a method for preparing industrial nylon filament, belonging to the technical field of spinning production. The method includes the following steps: Step 1, extruding: putting a nylon raw material into an extruder, melting at a high temperature, stirring, and extruding from a nozzle; Step 2, molding: extruding molten liquid from the nozzle, and enabling the molten liquid to enter a cooling tank for molding; Step 3, wire pulling: applying a certain tension to the wire in the cooling tank, and pulling out a molded nylon filament. A spool fully wound with the nylon filament is replaced without stopping a cutting and winding device, the efficiency of winding filament is greatly improved, and thus the production efficiency of the nylon filament is improved.

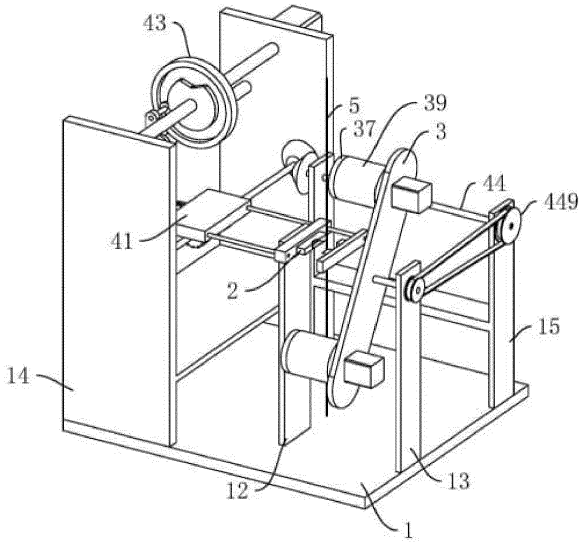


FIG. 1

EP 4 488 209 A1

## Description

### TECHNICAL FIELD

**[0001]** The present disclosure relates to a method for preparing an industrial nylon filament, belonging to the technical field of spinning production.

### BACKGROUND

**[0002]** In general, polymer materials for spinning include nylon (polyamide), polypropylene, polyethylene terephthalate, polyacrylonitrile, etc. These materials can be spun into fibers such as polyamide, polypropylene, polyester, and acrylic, which can be used in textile industry. Melt spinning is a common spinning method, and various fibers suitable for textile can be obtained through melt spinning. Generally, the fineness of a single filament obtained by melt spinning can reach 1.0 dtex. Products woven with the fibers with such fineness, such as clothing fabrics, have many advantages, and thus have market application space.

**[0003]** At present, the fiber raw materials are heated and extruded into fiber filament by an extruder, and then the fiber filament is wound by a winding machine after cooling. However, when the winding of the nylon filament on a single spool is completed, the winding machine needs to be stopped for replacing the spool, and then the winding machine is restarted for winding. Such a way has the problem of low winding efficiency, and thus the production efficiency of nylon filament is reduced.

**[0004]** Therefore, there is a need to put forward a new scheme to solve this problem.

### SUMMARY

**[0005]** The technical problem to be solved by the present disclosure is that a method for preparing an industrial nylon filament is provided, which solves the problems that in the prior art, a way of stopping a winder to replace a spool after the winding of a nylon filament on a single spool is completed and then restarting a winder for winding is low in winding efficiency, and the production efficiency of the nylon filament is reduced.

**[0006]** The technical problem to be solved by the present disclosure is achieved using the following technical solution, a method for preparing an industrial nylon filament includes the following steps:

Step 1, extruding: putting a nylon raw material into an extruder, melting at a high temperature, stirring, and extruding from a nozzle;
Step 2, molding: extruding molten liquid from the nozzle, and enabling the molten liquid to enter a cooling tank for molding;
Step 3, wire pulling: applying a certain tension to a wire in a cooling tank, and pulling out a molded nylon filament;
Step 4, stretching: winding and extruding the cooled nylon filament by a roller while applying a constant load to the nylon filament, thus improving strength;
Step 5, heating: heating the nylon filament while stretching, thus improving strength and hardness;
Step 6, repeating Step 4 and Step 5 for many times until the nylon filament reaches the standard; and
Step 7, winding: winding the nylon filament on a spool, cutting the wound nylon filament by a cutting and winding device, and switching to the next spool for winding the nylon filament without stopping the cutting and winding device.

**[0007]** By adopting the technical solution above, a spool fully wound with the nylon filament is replaced without stopping a cutting and winding device, the efficiency of winding filament is greatly improved, and thus the production efficiency of the nylon filament is improved.

**[0008]** A further arrangement of the present disclosure is as follows: the cutting and winding device includes a base, and a cutting mechanism and a winding mechanism are arranged on the base, respectively. The cutting mechanism includes:

a fixed seat, fixed to the base through a mounting plate, and
a sliding plate, relatively sliding on one side of the fixed seat.

**[0009]** Cutting blades are installed on opposite surfaces of the fixed seat and the sliding plate through mounting seats, and a cutting cavity is formed between the two cutting blades.

**[0010]** The winding mechanism includes:

a connecting plate, fixed to the base;
a rotating plate, rotatably connected to the connecting plate through a rotating shaft;
winding frames, rotatably connected to both ends, facing the sliding plate, of the rotating plate and driven to rotate by driving sources; and
a spool, installed on each winding frame and provided with a bonding layer on a surface.

**[0011]** The base is further provided with a driving assembly. On the one hand, the driving assembly is used to drive the sliding plate to slide with respect to the fixed seat to cut the nylon filament and to reset the sliding plate. On the other hand, the driving assembly drives the rotating plate to rotate in the reset process of the sliding plate, thus driving one spool to bond the nylon filament and rotate to a position below the cutting cavity.

**[0012]** A further arrangement of the present disclosure is as follows: the driving assembly includes:

a connecting frame, fixed to the base;
a driving plate, slidably connected to one side, away

from the sliding plate, of the fixed seat through two sliding rods;

a driving structure, rotatably connected into the connecting frame, and used to drive the driving plate to slide back and forth through rotation; and

a transmission mechanism, arranged on the base, and used to slide towards the fixed seat through the driving plate, thus driving the rotating shaft to rotate.

**[0013]** One end, away from the driving plate, of one sliding rod is fixed to the sliding plate through a connecting rod, a through slot for the nylon filament to pass through is formed between the fixed seat and the sliding plate and at one end away from the connecting rod.

**[0014]** A further arrangement of the present disclosure is as follows: the driving structure includes a first rotating rod rotatably connected into the connecting frame. A driving disc is fixed to the first rotating rod, and a sliding groove is formed in the driving disc in a circumferential direction. A second rotating rod is further fixed into the connecting frame, a shaft sleeve is rotatably connected to the second rotating rod, a sleeve is rotatably connected to an outer peripheral wall of the shaft sleeve, and a first driving block and a second driving block are fixed to both ends of the sleeve, respectively. One end of the first driving block is rotatably connected to a roller sliding in the sliding groove through a connecting shaft, and the second driving block is hinged with the driving plate through a hinged push plate.

**[0015]** A V-shaped driving groove is formed in an inner wall of the sliding groove, and a torsional spring is arranged between the sleeve and the shaft sleeve.

**[0016]** A further arrangement of the present disclosure is as follows: the transmission mechanism includes:

a third rotating rod, rotatably connected into the connecting frame;

a transmission structure, arranged at the bottom of the driving plate, and used to drive the third rotating rod to rotate;

a mounting frame, arranged on the base;

a fourth rotating rod, rotatably connected into the mounting frame, where one end of the fourth rotating rod is connected to the third rotating rod through a gear transmission part, and the other end of the fourth rotating rod extends out of the mounting frame; and

a pulley group, arranged between the mounting frame and the connecting plate, and used to drive the rotating shaft to rotate through the rotation of the fourth rotating rod.

**[0017]** A further arrangement of the present disclosure is as follows: the transmission structure includes a rack, the bottom of the driving plate is provided with a chute for the rack to slide in a vertical direction, a rotating wheel is fixed to the third rotating rod, multiple ratchet teeth for meshing with the rack are arranged on an outer peripheral wall of the rotating wheel. One end, away from the fixed seat, of the teeth at the bottom of the rack is provided with a guide inclined surface, and the other end of the rack is provided with an abutting plane for abutting against the ratchet.

**[0018]** A further arrangement of the present disclosure is as follows: the chute is internally provided with a plurality of elastic parts having both ends fixed to an inner top wall in the chute and a top wall of the rack, respectively.

**[0019]** A further arrangement of the present disclosure is as follows: the gear transmission part includes a first bevel gear fixed to the third rotating rod, and one end of the fourth rotating rod is provided with a second bevel gear meshed with the first bevel gear.

**[0020]** A further arrangement of the present disclosure is as follows: the pulley group includes a first pulley fixed to one end, extending out of the mounting frame, of the fourth rotating rod, and a second pulley fixed to the rotating shaft is arranged on an outer wall of the connecting plate. A synchronous belt is arranged between the first pulley and the second pulley, and a diameter of the first pulley is greater than that of the second pulley.

**[0021]** A further arrangement of the present disclosure is as follows: the winding frame includes a rotating disc fixed to the driving source. Two pins are arranged on the rotating disc, and both two ends of an inner peripheral wall of the spool are axially provided with slots for inserting the pins.

**[0022]** The present disclosure has the beneficial effects that:

1. The sliding plate is driven by the driving assembly to approach the fixed seat, making the two cutting blades approach each other to cut the nylon filament. After the cutting is completed, the sliding plate is reset under the driving of the driving assembly, and meanwhile, the driving assembly drives the rotating plate to rotate, thus driving a spool located obliquely above to bond a tail end of the nylon filament located above the cutting cavity through the bonding layer and start winding by rotation. After the rotating plate rotates, the spool originally located obliquely above moves to a position obliquely below while winding nylon filament, while the spool originally located obliquely below rotates to a position obliquely above and stops moving. At this time, a worker can easily disassemble the spool from the winding frame, and then install a new spool to repeat the above operation. Therefore, the non-stop operation of nylon filament winding is achieved, and the production efficiency of the nylon filament is greatly improved.

2. The first rotating rod is driven by the motor to rotate, the rotation of the first rotating rod drives the driving disc to rotate, thus making the roller slide in the sliding groove. The arrangement of the torsional spring makes one end, facing the axes of the driving disc, of the roller attached to an inner wall of

the sliding groove in a natural state, and when the roller slides to the V-shaped driving groove, under the elastic force of the torsional spring, the sleeve drives the first driving block, a connecting shaft and the roller to move from the deepest portion of the driving groove, i.e., driving the sleeve to rotate clockwise, to drive the second driving block and the push plate to pull the driving plate away from the fixed seat, thus driving the sliding plate to approach the fixed seat, and making the cutting blades cut the nylon filament to complete the cutting operation of the nylon filament.

3. When the driving plate slides away from the fixed seat, the guide inclined surface of the rack is abutted against the ratchet teeth. Under the guidance of the guide inclined surface, the rotating wheel cannot be driven by the rack, and the rack moves upwards to enter the chute to compress the elastic part, and thus the two spools remain in place during the process of cutting the nylon filament.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0023]**

FIG. 1 is a schematic diagram of a structure according to the present disclosure;
FIG. 2 is a structural schematic diagram of a driving structure and a cutting mechanism according to the present disclosure;
FIG. 3 is a structural schematic diagram of a transmission mechanism according to the present disclosure;
FIG. 4 is a sectional diagram of a driving plate and a rotating wheel according to the present disclosure;
FIG. 5 is a structural schematic diagram of a winding mechanism according to the present disclosure.

**[0024]** In the drawings: 1-base; 12-mounting plate; 13-connecting plate; 14-connecting frame; 15-mounting frame; 2-cutting mechanism; 21-fixed seat; 22-sliding plate; 23-cutting blade; 24-cutting cavity; 25-through slot; 26-mounting seat; 3-winding mechanism; 31-rotating plate; 32-rotating shaft; 33-winding frame; 34-driving source; 35-rotating disc; 36-pin; 37-spool; 38-slot; 39-bonding layer; 41-driving plate; 411-chute; 42-sliding rod; 421-connecting rod; 43-driving structure; 431-first rotating rod; 432-motor; 433-driving disc; 434-sliding groove; 435-second rotating rod; 436-shaft sleeve; 437-sleeve; 4371-first driving block; 4372-second driving block; 4373-connecting shaft; 4374-roller; 4375-push plate; 438-torsional spring; 439-driving groove; 44-transmission mechanism; 441-third rotating rod; 442-fourth rotating rod; 4421-first bevel gear; 4422-second bevel gear; 443-rack; 444-rotating wheel; 445-ratchet tooth; 446-guide inclined surface; 447-abutting plane; 448-elastic part; 449-pulley group; 4491-first pulley; 4492-second pulley; 4493-synchronous belt; 5-nylon filament.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

**[0025]** In order to easily understand the technical means, creative features, objectives and effects of the present disclosure, the present disclosure will be further set forth with specific illustrations.

**[0026]** A method for preparing an industrial nylon filament includes the following step:

Step 1, extruding: putting a nylon raw material into an extruder, melting at a high temperature, stirring, and extruding from a nozzle;
Step 2, molding: extruding molten liquid from the nozzle, and enabling the molten liquid to enter a cooling tank for molding;
Step 3, wire pulling: applying a certain tension to a wire in a cooling tank, and pulling out a molded nylon filament 5;
Step 4, stretching: winding and extruding the cooled nylon filament by a roller while applying a constant load to the nylon filament, thus improving strength;
Step 5, heating: heating the nylon filament while stretching, thus improving strength and hardness;
Step 6, repeating Step 4 and Step 5 for many times until the nylon filament reaches the standard; and
Step 7, winding: winding the nylon filament 5 on a spool 37, cutting the wound nylon filament by a cutting and winding device, and switching to the next spool 37 for winding the nylon filament 5 without stopping the cutting and winding device.

**[0027]** The spool 37 fully wound with the nylon filament 5 is replaced without stopping a cutting and winding device, the efficiency of winding filament is greatly improved, and thus the production efficiency of the nylon filament 5 is improved.

**[0028]** As shown in FIG. 1, the cutting and winding device includes a base 1, and a cutting mechanism 2, a winding mechanism 3 and a driving assembly are arranged on the base 1, respectively, specifically as follows.

**[0029]** As shown in FIG. 2, the cutting mechanism 2 includes:

a fixed seat 21, fixed to the base 1 through a mounting plate 12, and
a sliding plate 22, relatively sliding on one side of the fixed seat 21.

**[0030]** Cutting blades 23 are installed on opposite surfaces of the fixed seat 21 and the sliding plate 22 through mounting seats 26, and a cutting cavity 24 is formed between the two cutting blades 23.

**[0031]** As shown in FIG. 5, the winding mechanism 3 includes:

a connecting plate 13, fixed to the base 1;
a rotating plate 31, rotatably connected to the con-

necting plate 13 through a rotating shaft 32;
winding frames 33, rotatably connected to both ends, facing the sliding plate 22, of the rotating plate 31 and driven to rotate by driving sources 34; and
a spool 37, installed on each winding frame 33 and provided with a bonding layer 39 on a surface.

**[0032]** Specifically, the winding frame includes a rotating disc fixed to the driving source 34, and the spool 37 is embedded into the rotating disc 35. In addition, two pins 36 are arranged on the rotating disc 35, and both two ends of an inner peripheral wall of the spool 37 are axially provided with slots 38 for inserting the pins 36.

**[0033]** On the one hand, the driving assembly is used to drive the sliding plate 22 to slide with respect to the fixed seat 21 to cut the nylon filament and to reset. On the other hand, the driving assembly drives the rotating plate 31 to rotate in the reset process of the sliding plate 22, thus driving one spool 37 to bond the nylon filament and rotate to a position below the cutting cavity 24.

**[0034]** In the production process of the nylon filament 5, the nylon filament 5 is located inside the cutting cavity 24, and a tail end of the nylon filament 5 extends to a position below the cutting cavity 24. The spool 37 is mounted on each of the two winding frames 33, that is, the spool 37 is embedded into the rotating disc 35, and the pin 36 is clamped into the slot 38, such that the spool 37 is clamped with the winding frame 33 and is convenient for disassembling subsequently. Afterwards, under the driving of the driving source 34, the rotating plate 31 and the two spools 37 are driven to be located diagonally above and below the nylon filament 5 and on both sides of the nylon filament 5, and then the tail end of the nylon filament 5 is bonded on the bonding layer 39 of the spool 37 located diagonally blow the nylon filament, and then the driving source 34 is started to drive the winding frame 33 and the spool 37 located diagonally below to start rotation and wind the nylon filament 5.

**[0035]** After the winding is completed, the sliding plate 22 is driven by the driving assembly to approach the fixed seat 21, making the two cutting blades 23 approach each other to cut the nylon filament 5. After the cutting is completed, the sliding plate 22 is reset under the driving of the driving assembly, and meanwhile, the driving assembly drives the rotating plate 31 to rotate, thus driving a spool 37 located obliquely above to bond a tail end of the nylon filament 5 located above the cutting cavity 24 through the bonding layer 39 and start winding by rotation. After the rotating plate 31 rotates, the spool 37 originally located obliquely above moves to a position obliquely below while winding the nylon filament, while the spool 37 originally located obliquely below rotates to a position obliquely above and stops moving. At this time, a worker can easily disassemble the spool 33 from the winding frame 37, and then install a new spool 37 to repeat the above operation. Therefore, the non-stop operation of nylon filament 5 winding is achieved, and the production efficiency of the nylon filament 5 is greatly improved.

**[0036]** As shown in FIG. 2 to FIG. 5, the driving assembly includes:

a connecting frame 14, fixed to the base 1;
a driving plate 41, slidably connected to one side, away from the sliding plate 22, of the fixed seat 21 through two sliding rods 42;
a driving structure 43, rotatably connected into the connecting frame 14, and used to drive the driving plate 41 to slide back and forth through rotation; and
a transmission mechanism 44, arranged on the base 1, and used to slide towards the fixed seat 21 through the driving plate, thus driving the rotating shaft to rotate.

**[0037]** One end, away from the driving plate 41, of one sliding rod 42 is fixed to the sliding plate 22 through a connecting rod 421, a through slot 25 for the nylon filament 5 to pass through is formed between the fixed seat 21 and the sliding plate 22 and at one end away from the connecting rod 421.

**[0038]** The driving plate 41 is driven by the driving structure 43 to slide back and forth and drives the sliding rod 42 to move, such that the sliding plate 22 can move back and forth. Only one sliding rod 42 is connected to the sliding plate 22 through the connecting rod 421, and thus the through slot 25 can be formed in the other side of the fixed seat 21 and the sliding plate 22. Therefore, the nylon filament 5 can pass through the through slot 25 without being limited in the process that the spool 37 located obliquely above winds the nylon filament 5 and rotates to a position obliquely below, and the winding of the spool 37 and the operation of driving the nylon filament 5 to the position obliquely below are achieved.

**[0039]** In addition, due to the arrangement of the transmission mechanism 44, the rotating shaft 32 can be driven to rotate only in the process that the driving plate 41 approaches the fixed seat 21, i.e., driving the sliding plate 22 to reset. In this case, the sliding plate 22 approaches the fixed seat 21, that is, during the cutting, the rotating shaft 32 cannot drive the rotating plate 31 to rotate, and thus the spool 37 can remain stable during the cutting, the rotating plate 31 starts to rotate after the cutting is completed, making cutting process of the nylon filament 5 more stable.

**[0040]** As shown in FIG. 5, the driving structure 43 includes a first rotating rod 431 rotatably connected into the connecting frame 14. A motor 432 for driving the first rotating rod 431 to rotate is arranged outside the connecting frame 14. A driving disc 433 is fixed to one end, located in the connecting frame 14, of the first rotating rod 431, and a sliding groove 434 is formed in the driving disc 433 in a circumferential direction. A second rotating rod 435 is further fixed into the connecting frame 14, a shaft sleeve 436 is rotatably connected to the second rotating rod 435, a sleeve 437 is rotatably connected to an outer peripheral wall of the shaft sleeve 436, and a torsional

spring 438 is arranged between the sleeve 437 and the shaft sleeve 436. A first driving block 4371 and a second driving block 4372 are fixed to both ends of the sleeve 437, respectively. One end of the first driving block 4371 is rotatably connected to a roller 4374 sliding in the sliding groove 434 through a connecting shaft 4373, and the second driving block 4372 is hinged with the driving plate 41 through a hinged push plate 4375.

**[0041]** A V-shaped driving groove 439 is formed in an inner wall of the sliding groove 434.

**[0042]** When the nylon filament 5 needs to be cut, the first rotating rod 431 is driven by the motor 432 to rotate, the first rotating rod 431 rotates to drive the driving disc 433 to rotate, thus making the roller 4374 slide in the sliding groove 434. The arrangement of the torsional spring 438 makes one end, facing the axis of the driving disc 433, of the roller 4374 attached to an inner wall of the sliding groove 434 in a natural state. When the roller 4374 slides to the V-shaped driving groove 439, under the elastic force of the torsional spring 438, the sleeve 437 drives the first driving block 4371, the connecting shaft 4373 and the roller 4374 to move from the deepest portion of the driving groove 439, i.e., driving the sleeve 437 to rotate clockwise, thus driving the second driving block 4372 and the push plate 4375 to pull the driving plate 41 away from the fixed seat 21, thus driving the sliding plate 22 to approach the fixed seat 2. The two cutting blades 23 can cut the nylon filament 5 to complete the cutting operation of the nylon filament 5, and the operation is convenient.

**[0043]** After the cutting is completed, that is, the roller 4374, after moving to the deepest portion of the driving groove 439, continues to rotate with the first rotating rod 431, the roller 4374 slides away from the axis of the driving disc 433 along an inner wall of the driving groove 439, thus driving the sleeve 437 to rotate counterclockwise, and then driving the sliding plate 22 away from the fixed seat 21 to achieve the reset operation of the sliding plate 22, and the operation is convenient. Meanwhile, the inner and outer diameters of the sliding groove 434 are the same everywhere, and thus the sleeve 437 always remains stable when the roller 4374 slides in the sliding groove 434.

**[0044]** As shown in FIG. 4, the transmission mechanism 44 includes:

a third rotating rod 441, rotatably connected into the connecting frame 14,

a transmission structure, arranged at the bottom of the driving plate 41, and used to drive the third rotating rod 441 to rotate;

a mounting frame 15, arranged on the base 1;

a fourth rotating rod 442, rotatably connected into the mounting frame 15, where one end of the fourth rotating rod 442 is connected to the third rotating rod 441 through a gear transmission part, and the other end of the fourth rotating rod 441 extends out of the mounting frame 15; and

a pulley group 449, arranged between the mounting frame 15 and the connecting plate 13, and used to drive the rotating shaft 32 to rotate through the rotation of the fourth rotating rod 442.

**[0045]** When the rotating shaft 32 needs to be driven to rotate, the sliding of the driving plate 41 can drive the transmission structure to drive the third rotating rod 441 to rotate, thus making the first bevel gear 4421 rotate. The second bevel gear 4422 meshed with the first bevel gear 4421 rotates accordingly to drive the fourth rotating rod 442 to rotate. Under the driving of the fourth rotating rod 442, the first pulley 4491 rotates to drive the second pulley 4492 and the rotating shaft 32 to rotate through the synchronous belt 4493, thus achieving an operation of driving the rotating shaft 32 and the rotating plate 31 to rotate through the driving plate 41, and making the operation of exchanging the positions of the two spools 37 and the winding frames 33 more conveniently.

**[0046]** As a diameter of the first pulley 4491 is greater than that of the second pulley 4492, when the first pulley 4491 rotates one turn, the second pulley 4492 can rotate more number of turns than that of the first pulley 4491, thus making up for the deviation of the number of turns generated when the transmission structure drives the third rotating rod 441 to rotate.

**[0047]** As shown in FIG. 4, the transmission structure includes a rack 443. The bottom of the driving plate 41 is provided with a chute 411 for the rack 443 to slide in a vertical direction, a rotating wheel 444 is fixed to the third rotating rod 441, and multiple ratchet teeth 445 for meshing with the rack 443 are arranged on an outer peripheral wall of the rotating wheel 444. One end, away from the fixed seat 21, of the teeth at the bottom of the rack 443 is provided with a guide inclined surface 446, and the other end of the rack 443 is provided with an abutting plane 447 for abutting against the ratchet 445. The chute 411 is internally provided with a plurality of elastic parts 448 having both ends fixed to an inner top wall in the chute 411 and a top wall of the rack 443, respectively.

**[0048]** When the driving plate 41 slides away from the fixed seat 21, the guide inclined surface 446 of the rack 443 is abutted against the ratchet teeth 445. Under the guidance of the guide inclined surface 446, the rotating wheel 444 cannot be driven by the rack 443, and the rack 443 moves upwards to enter the chute 411 to compress the elastic part 448, and thus the two spools 37 remain in place during the process of cutting the nylon filament 5. Moreover, the operation is convenient.

**[0049]** In the process of driving the sliding plate 22 to reset by the driving plate 41, the abutting plane 447 is abutted against the ratchet teeth 445 to drive the ratchet teeth 445 and the rotating wheel 444 to rotate, thus driving the third rotating rod 441 to rotate, and further driving the rotating shaft 32 to rotate. The operation that, only when the sliding plate 22 is reset, that is, after the cutting of the nylon filament 5 is completed, the rotating shaft 32 drives the rotating plate 31 to rotate, and the two

spools 37 and the winding frame 33 exchange positions with each other can be achieved. Moreover, the operation is convenient.

**[0050]** The basic principle, main features and advantages of the present disclosure have been shown and described above. It should be understood by those skilled in the art that the present disclosure is not limited by the above embodiments, and there will be various changes and improvements without departing from the spirit and scope of the present disclosure, all of which shall fall within the scope of protection of the present disclosure. The scope of the present disclosure is defined by the appended claim and their equivalents.

## Claims

**1.** A method for preparing an industrial nylon filament, comprising the following step:

Step 1, extruding: putting a nylon raw material into an extruder, melting at a high temperature, stirring, and extruding from a nozzle;
Step 2, molding: extruding molten liquid from the nozzle, and enabling the molten liquid to enter a cooling tank for molding;
Step 3, wire pulling: applying a certain tension to a wire in a cooling tank, and pulling out a molded nylon filament (5);
Step 4, stretching: winding and extruding the cooled nylon filament by a roller while applying a constant load to the nylon filament, thus improving strength;
Step 5, heating: heating the nylon filament while stretching, thus improving strength and hardness;
Step 6, repeating Step 4 and Step 5 for many times until the nylon filament reaches the standard; and
Step 7, winding: winding the nylon filament on a spool (37), cutting the wound nylon filament by a cutting and winding device, and switching to the next spool (37) for winding the nylon filament without stopping the cutting and winding device.

**2.** The method for preparing an industrial nylon filament according to claim 1, wherein the cutting and winding device comprises a base (1), a cutting mechanism (2) and a winding mechanism (3) are arranged on the base (1), respectively; the cutting mechanism (2) comprises:

a fixed seat (21), fixed to the base (1) through a mounting plate (12), and
a sliding plate (22), relatively sliding on one side of the fixed seat (21);
cutting blades (23) are installed on opposite surfaces of the fixed seat (21) and the sliding plate (22) through mounting seats (26), and a cutting cavity (24) is formed between the two cutting blades (23);
the winding mechanism (3) comprises:

a connecting plate (13), fixed to the base (1);
a rotating plate (31), rotatably connected to the connecting plate (13) through a rotating shaft (32);
winding frames (33), rotatably connected to both ends, facing the sliding plate (22), of the rotating plate (31) and driven to rotate by driving sources (34);
a spool (37), installed on each winding frame (33) and provided with a bonding layer (39) on a surface;
the base (1) is further provided with a driving assembly, on the one hand, the driving assembly is used to drive the sliding plate (22) to slide with respect to the fixed seat (21) to cut the nylon filament and to reset the sliding plate (22); on the other hand, the driving assembly drives the rotating plate (31) to rotate in the reset process of the sliding plate (22), thus driving one spool (37) to bond the nylon filament and rotate to a position below the cutting cavity (24).

**3.** The method for preparing an industrial nylon filament according to claim 2, wherein the driving assembly comprises:

a connecting frame (14), fixed to the base (1);
a driving plate (41), slidably connected to one side, away from the sliding plate (22), of the fixed seat (21) through two sliding rods (42);
a driving structure (43), rotatably connected into the connecting frame (14), and used to drive the driving plate (41) to slide back and forth through rotation;
a transmission mechanism (44), arranged on the base (1), and used to slide towards the fixed seat (21) through the driving plate, thus driving the rotating shaft to rotate;
wherein one end, away from the driving plate (41), of one sliding rod (42) is fixed to the sliding plate (22) through a connecting rod (421), a through slot (25) for the nylon filament (5) to pass through is formed between the fixed seat (21) and the sliding plate (22) and at one end away from the connecting rod (421).

**4.** The method for preparing an industrial nylon filament according to claim 3, wherein the driving structure (43) comprises a first rotating rod (431) rotatably connected into the connecting frame (14), a driving disc (433) is fixed to the first rotating rod (431), and a

sliding groove (434) is formed in the driving disc (433) in a circumferential direction; a second rotating rod (435) is further fixed into the connecting frame (14), a shaft sleeve (436) is rotatably connected to the second rotating rod (435), a sleeve (437) is rotatably connected to an outer peripheral wall of the shaft sleeve (436), and a first driving block (4371) and a second driving block (4372) are fixed to both ends of the sleeve (437), respectively; one end of the first driving block (4371) is rotatably connected to a roller (4374) sliding in the sliding groove (434) through a connecting shaft (4373), and the second driving block (4372) is hinged with the driving plate (41) through a hinged push plate (4375); and
a V-shaped driving groove (439) is formed in an inner wall of the sliding groove (434), and a torsional spring (438) is arranged between the sleeve (437) and the shaft sleeve (436).

**5.** The method for preparing an industrial nylon filament according to claim 3, wherein the transmission assembly (44) comprises

a third rotating rod (441), rotatably connected into the connecting frame (14),
a transmission structure, arranged at the bottom of the driving plate (41), and used to drive the third rotating rod (441) to rotate;
a mounting frame (15), arranged on the base (1);
a fourth rotating rod (442), rotatably connected into the mounting frame (15), wherein one end of the fourth rotating rod (442) is connected to the third rotating rod (441) through a gear transmission part, and the other end of the fourth rotating rod (441) extends out of the mounting frame (15); and
a pulley group (449), arranged between the mounting frame (15) and the connecting plate (13), and used to drive the rotating shaft (32) to rotate through the rotation of the fourth rotating rod (442).

**6.** The method for preparing an industrial nylon filament according to claim 5, wherein the transmission structure comprises a rack (443), the bottom of the driving plate (41) is provided with a chute (411) for the rack (443) to slide in a vertical direction, a rotating wheel (444) is fixed to the third rotating rod (441), a plurality of ratchet teeth (445) for meshing with the rack (443) are arranged on an outer peripheral wall of the rotating wheel (444), one end, away from the fixed seat (21), of the teeth at the bottom of the rack (443) is provided with a guide inclined surface (446), and the other end of the rack (443) is provided with an abutting plane (447) for abutting against the ratchet (445).

**7.** The method for preparing an industrial nylon filament according to claim 6, wherein the chute (411) is internally provided with a plurality of elastic parts (448) having both ends fixed to an inner top wall in the chute (411) and a top wall of the rack (443), respectively.

**8.** The method for preparing an industrial nylon filament according to claim 5, wherein the gear transmission part comprises a first bevel gear (4421) fixed to the third rotating rod (441), and one end of the fourth rotating rod (442) is provided with a second bevel gear (4442) meshed with the first bevel gear (4421).

**9.** The method for preparing an industrial nylon filament according to claim 5, wherein the pulley group (449) comprises a first pulley (4491) fixed to one end, extending out of the mounting frame (15), of the fourth rotating rod (442), and a second pulley (4492) fixed to the rotating shaft (32) is arranged on an outer wall of the connecting plate (13); a synchronous belt (4493) is arranged between the first pulley (4491) and the second pulley (4492), and a diameter of the first pulley (4491) is greater than that of the second pulley (4492).

**10.** The method for preparing an industrial nylon filament according to claim 2, wherein the winding frame (33) comprises a rotating disc (35) fixed to the driving source (34), two pins (36) are arranged on the rotating disc (35), and both two ends of an inner peripheral wall of the spool (37) are axially provided with slots (38) for inserting the pins (36).

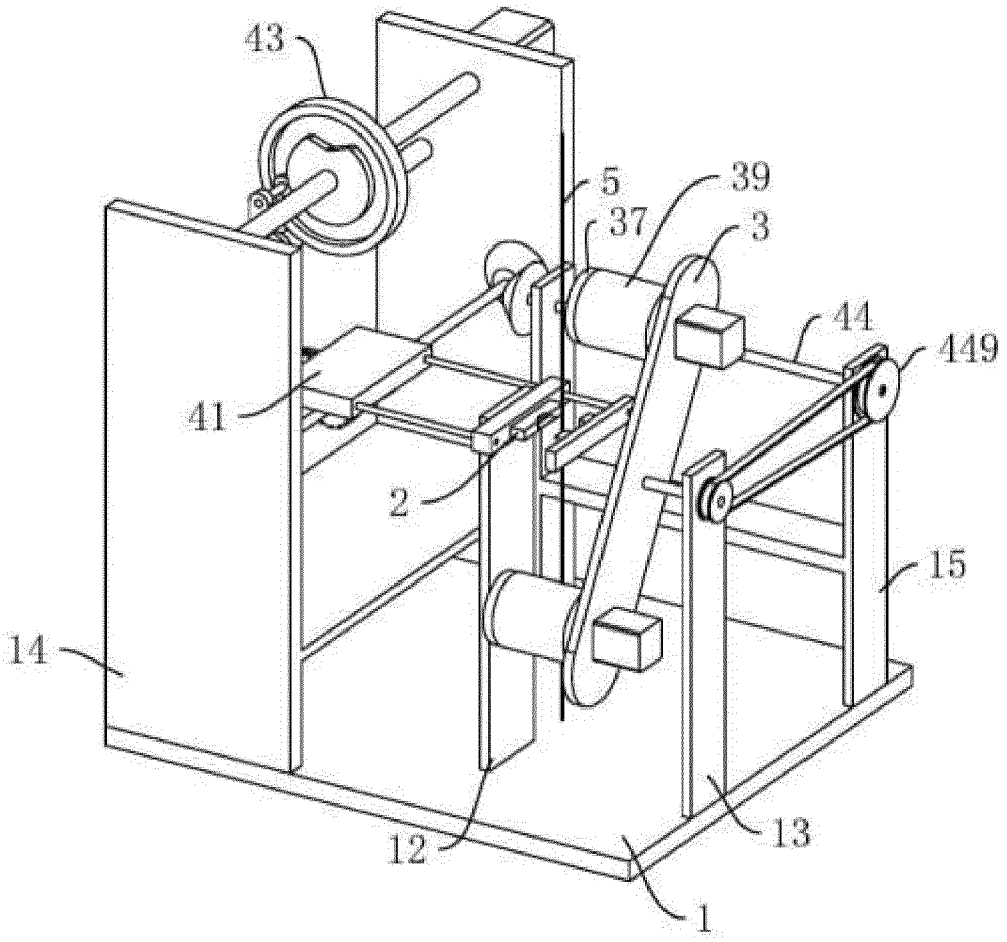
43
5
39
37
3
44
449
41
2
15
14
12
13
1

FIG. 1

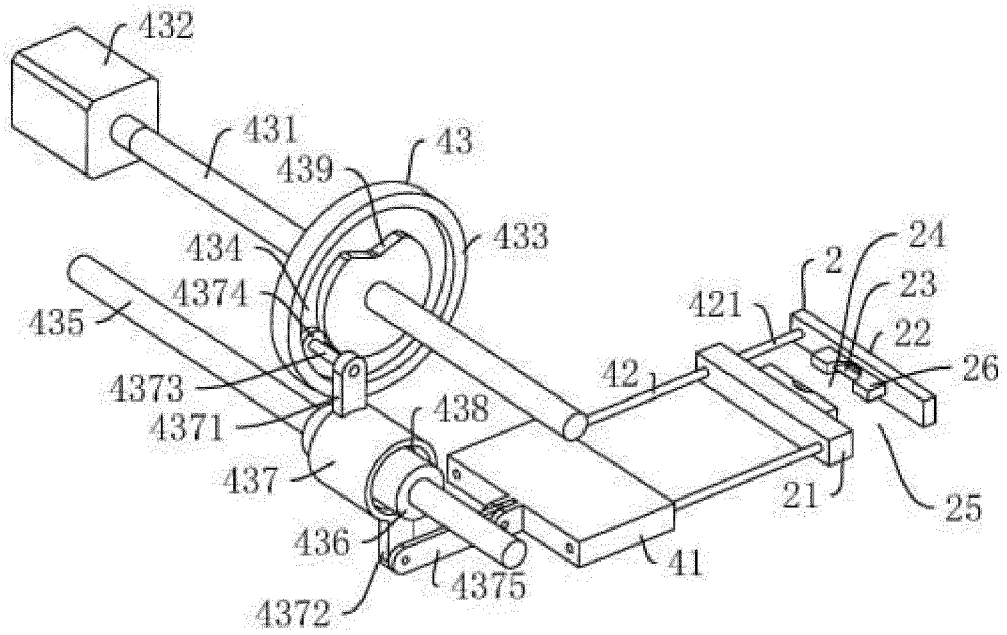
432
431
439
43
434
433
4374
435
4373
4371
438
437
436
4372
4375
41
42
421
2
24
23
22
26
21
25

FIG. 2

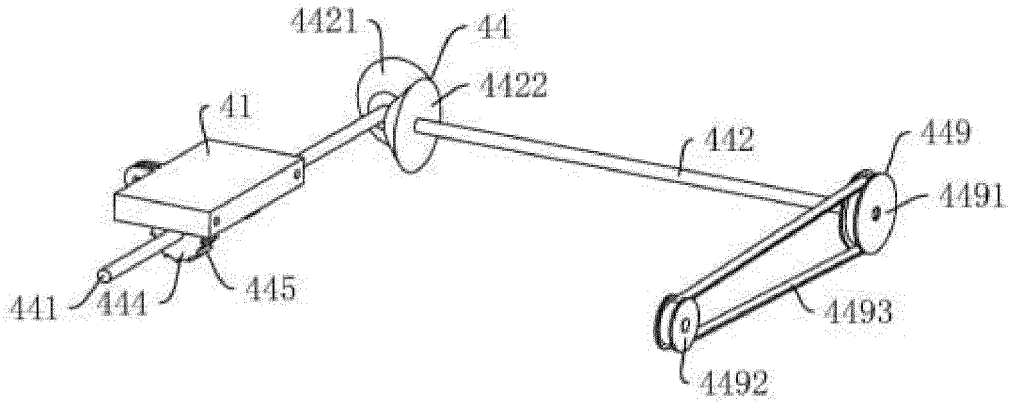
4421
44
4422
41
442
449
4491
441
444
445
4493
4492

FIG. 3

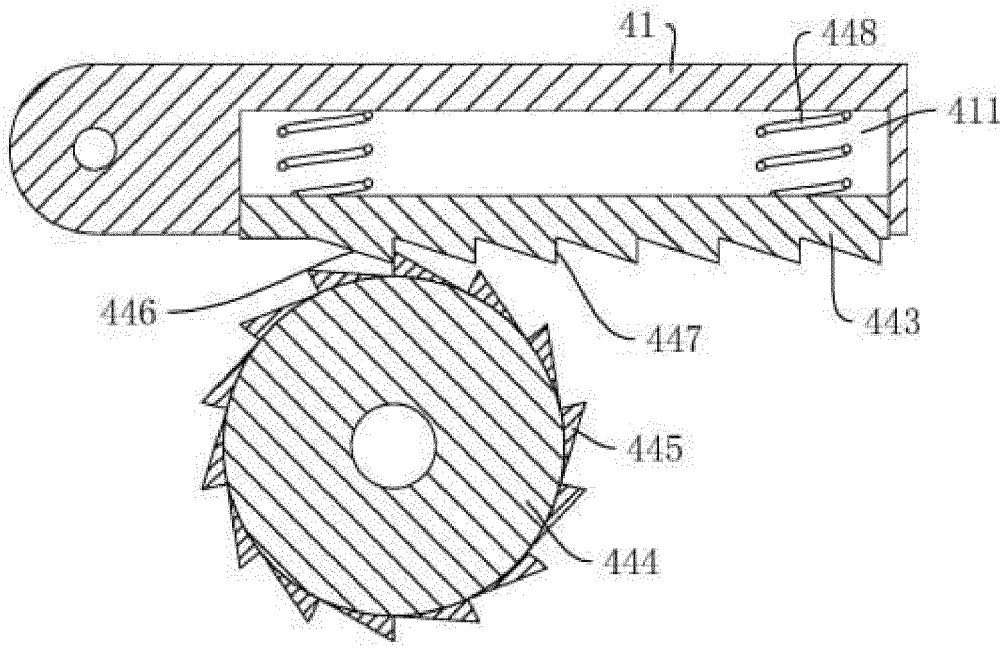
41
448
411
446
447
443
445
444

FIG. 4

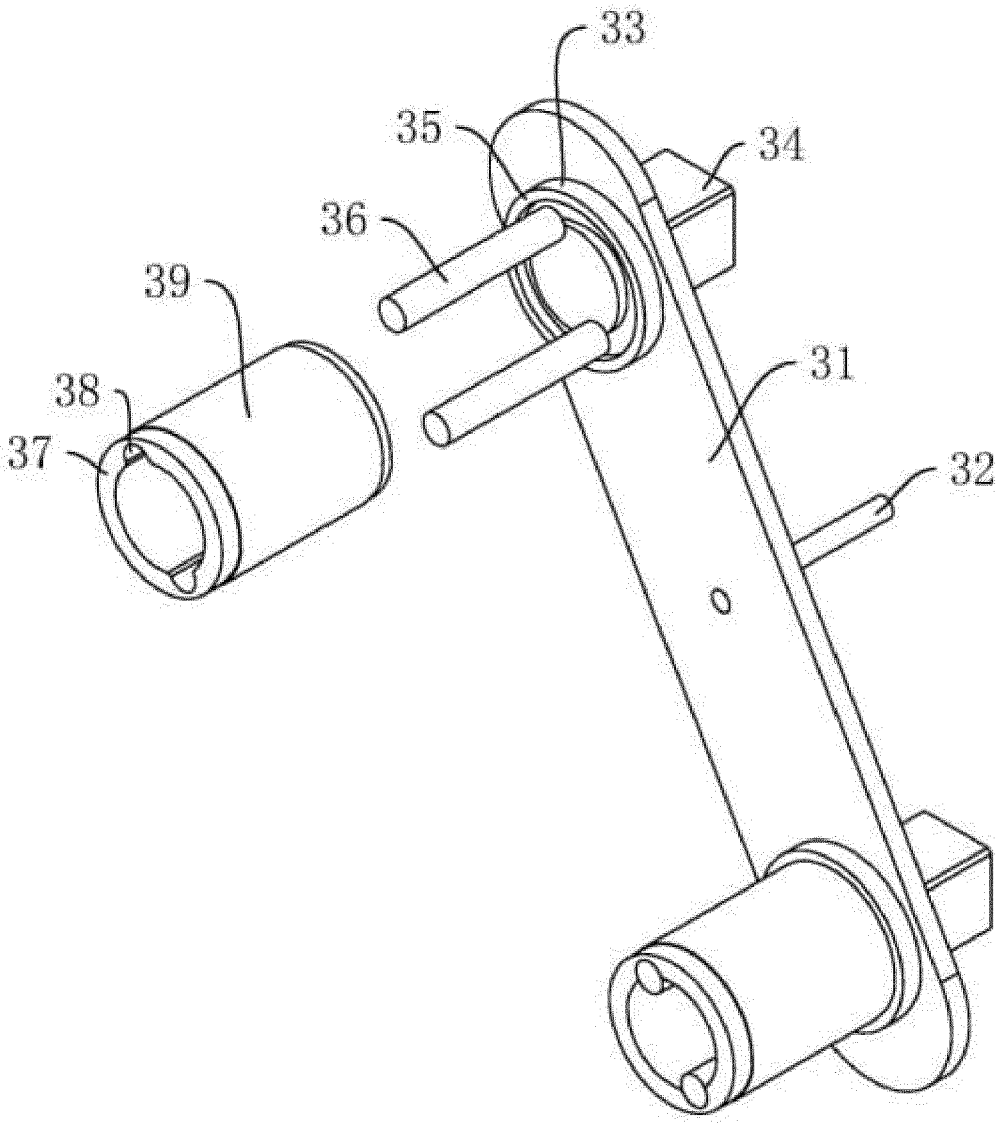


FIG. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

# EUROPEAN SEARCH REPORT

Application Number
EP 24 18 3070

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X<br>A | CH 317 573 A (INVENTA AG [CH])<br>30 November 1956 (1956-11-30)<br>* the whole document * | 1<br>2-10 | INV.<br>B65H67/048<br>D01D5/088<br>D01F6/60 |
| Y | US 5 785 997 A (BUEDENBENDER J [DE] ET AL)<br>28 July 1998 (1998-07-28)<br>* claims 1-4; figure 1 * | 1 | B65H54/71 |
| Y | US 5 082 611 A (ADAMS EARL B [US] ET AL)<br>21 January 1992 (1992-01-21)<br>* claim 10; figure 1 * | 1 | |
| Y | CN 115 627 549 A (FUJIAN JINGFENG TECH CO LTD) 20 January 2023 (2023-01-20)<br>* abstract; figure 1 * | 1 | |
| Y | US 2 772 054 A (LUDWIG HERELE ET AL)<br>27 November 1956 (1956-11-27)<br>* column 1, line 18 - column 3, line 52; figures 1,2 * | 1 | |
| Y | EP 0 359 453 A2 (ASAHI CHEMICAL IND [JP])<br>21 March 1990 (1990-03-21)<br>* page 3, lines 2-52 * | 1 | TECHNICAL FIELDS SEARCHED (IPC)<br>B65H<br>D01F<br>D01D |
| Y | US 5 150 640 A (SCHNITZER TADEUSZ E [US])<br>29 September 1992 (1992-09-29)<br>* column 4, line 25 - column 5, line 18; figures 1A-1H * | 1 | |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 23 October 2024 | Pussemier, Bart |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 18 3070

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-10-2024

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| CH 317573 A | 30-11-1956 | NONE | |
| US 5785997 A | 28-07-1998 | AT E175454 T1 | 15-01-1999 |
| | | CA 2118478 A1 | 23-04-1995 |
| | | DE 4336097 A1 | 27-04-1995 |
| | | EP 0649920 A1 | 26-04-1995 |
| | | ES 2127328 T3 | 16-04-1999 |
| | | JP 3575842 B2 | 13-10-2004 |
| | | JP H07166411 A | 27-06-1995 |
| | | US 5518670 A | 21-05-1996 |
| | | US 5785997 A | 28-07-1998 |
| US 5082611 A | 21-01-1992 | AR 243244 A1 | 30-07-1993 |
| | | AT E167707 T1 | 15-07-1998 |
| | | AT E167710 T1 | 15-07-1998 |
| | | BR 8903505 A | 13-03-1990 |
| | | CN 1040230 A | 07-03-1990 |
| | | DE 68912669 T2 | 25-08-1994 |
| | | DE 68928719 T2 | 04-03-1999 |
| | | DE 68928720 T2 | 04-03-1999 |
| | | EP 0350945 A2 | 17-01-1990 |
| | | EP 0540062 A2 | 05-05-1993 |
| | | EP 0541133 A2 | 12-05-1993 |
| | | HK 1011149 A1 | 02-07-1999 |
| | | HK 1011150 A1 | 02-07-1999 |
| | | JP 2838113 B2 | 16-12-1998 |
| | | JP H02127507 A | 16-05-1990 |
| | | KR 910003179 A | 27-02-1991 |
| | | MX 165672 B | 27-11-1992 |
| | | US 5082611 A | 21-01-1992 |
| CN 115627549 A | 20-01-2023 | NONE | |
| US 2772054 A | 27-11-1956 | NONE | |
| EP 0359453 A2 | 21-03-1990 | DE 68910762 T2 | 31-03-1994 |
| | | EP 0359453 A2 | 21-03-1990 |
| | | ES 2046488 T3 | 01-02-1994 |
| | | KR 900004988 A | 13-04-1990 |
| US 5150640 A | 29-09-1992 | NONE | |

EPO FORM P0459

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