Methods of winding, annealing and unwinding a polymer film web, an annealing apparatus and a photographic film support prepared using said method or apparatus

Wickel-, Temper- und Abwickelverfahren eines Polymerfilms, eine Tempervorrichtung und ein photographischer Filmträger hergestellt mit diesem Verfahren oder Vorrichtung

Procédé de roulage, recuit et déroulage d’un film polymère, un dispositif de recuit et un support de film photographique produit par ce procédé ou dispositif
Description

[0001] The present invention relates to a method of winding a continuous polymer film strip (hereinafter, occasionally called "web") into a roll, and to a method of annealing a film roll. Furthermore, the present invention relates to an apparatus for annealing a film roll. Specifically, the present invention provides improved techniques for preparing a photographic film support by uniformly subjecting a polymer film web to heat or annealing treatment.

[0002] Polymer films, particularly polyester films, are subjected to heat treatment to remove residual strain arising from their manufacturing process. This heat treatment is called an annealing treatment.

[0003] In carrying out such an annealing treatment, there has been adopted a method of storing a film which has been rolled up (a film roll) for predetermined time in a thermostatic chamber which is kept the temperature therein at a high temperature, or a method of slowly passing a film roll through a continuous oven. When a film roll is heated ununiformly in such an annealing process, various problems arise such that the film roll suffers starring, winding wrinkles or winding ruggedness. In addition, a prolonged period is required for effecting an annealing treatment.

[0004] To solve the above described problems, the following techniques have been proposed.

(1) JP-B-05-19899 (the term "JP-B" means an "examined Japanese patent publication") discloses a heat treating method where a film placed in an oven for heat treatment is heated up to a heat treatment temperature while it is continuously wound up into a roll as spacers are put along both side edges of the film, and then the spacer-interposed roll is stored at the heat treatment temperature for a predetermined time.

(2) JP-A-59-207346 (the term "JP-A" means an "unexamined published Japanese patent application") discloses an apparatus and method in accordance with the preambles of claims 1, 3 and 4, for winding a web equipped with an air chamber arranged at a predetermined interval with a web so that the web is subjected to hot-air blowing from air chambers to thereby control the web temperature.

However, any of the above-cited proposals (1) and (2) have no description about a core temperature. Therefore, these proposals are disadvantageous in that a wound film shrinks because of the temperature deference with a core, which results in surface defects (such as wrinkles, ruggedness, scratches and the like). In addition, these proposals have a problem in controlling the winding tightness of a film roll.

Furthermore, to avoid the above described starring, winding wrinkles or winding ruggedness, and to prevent from generating elliptical distortion and wrinkles, JP-A-63-31962 discloses a method of storing a plastic film that has been wound onto a reel into a roll with a space rate of from 0.6 to 0.95 while rotating the reel centering around the reel axis at a speed of from 5 to 1,000 revolutions per hour.

The method as described in JP-A-63-31962 is successful in preventing the generation of the elliptical distortion and wrinkles upon long-term storage. However, it has problems that temperature ununiformity is locally present in a thermostatic chamber used therein, and therefore, the effects on the reduction of annealing time and on the enhancement of annealing efficiency are inadequate.

Furthermore, conventional methods cannot avoid ununiformity in heating upon annealing treatment which results in temperature ununiformity of a film roll between the core side part and the periphery side part, and ununiform loading.

In the conventional methods, the entire film roll of a polymer film web is cooled to room temperature (about 25°C) after an annealing treatment, and thereafter the film roll is unwound.

An edge-thickening processing called "knurling", in which both edge parts of a polymer film web is deformed to be rugged, has so far been employed to prevent telescoping in the film roll. This knurling processing plays an important role in the above described annealing treatment as well, and it is not to be dispensed with for ensuring uniform heating and loading applied to a polymer film web.

Typical conventional techniques relating to edge-thickening processing, i.e., knurling, include the followings:

(3) JP-B-50-36459 discloses a method of winding a synthetic resin comprising subjecting a part of the film surface in the width direction (side zones on the film surface) to a treatment for enhancing antislip properties (specifically, a corona discharge treatment) followed by winding.

(4) JP-B-57-36129 discloses an apparatus for an edge thickening apparatus, with which edge parts of a molded thermoplastic sheet material are mechanically deformed to be rugged. Specifically, the apparatus comprises means for mechanical deforming which comprises a pair of rollers having a rugged surface and means for bringing them into pressure contact, in which at least one of the rollers has such surface roughness that striped gaps are arranged in the width direction on the curved surface of the roller so as to left traces of the gaps on the parts to thicken the sheet material.

In the conventional techniques, however, measures were not sufficiently taken to the problem that a film roll as a whole lacks uniformity in heated and loaded conditions. Furthermore, although the disclosed techniques relating to the knurling processing are effective measures to telescoping, there is no description with respect to measures for avoiding ununiformity on the film roll between the core side part and the surface side part occurring in an annealing treatment. Specifically, sharp swelling, cut-end-mark and imprints of a core texture are generated in the core part and ruggedness are generated in the periphery part during or after the annealing treatment. Furthermore, telescoping, starring wrinkles and wrinkles around the core are generated in an unwinding operation after the annealing treatment.

Example 3 of EP-A-665463 (prior art according to Article 54(3) and (4) EPC) discloses a method of winding a polymer film around a winding core, said winding core being provided in a box-like container the inside of which being heated to a temperature ranging from 60 to 140°C by blowing hot air into the box-like container. The outside of the box-like container is enclosed by a heat-insulating material. Immediately after winding, the wound polymer film is taken out of the box-like container and conveyed into an isothermal chamber for annealing.

A first object of the present invention is to provide a method of winding a film web into a film roll and a method of annealing the film roll, which cause no surface defects arising from film shrinkage attributed to the core temperature (such as wrinkles, ruggedness and scratches) by adopting an effective method for heating the core, and in which the film is wound under an uniform temperature condition and the winding tightness of the film roll can be controlled to provide sufficient effects upon reduction in winding wrinkles and winding ruggedness.

A second object of the present invention is to provide a method and an apparatus for heat treatment of film roll(s), which enable efficient and rapid annealing treatment as well as sufficient reduction of surface defects such as winding wrinkles, winding ruggedness which are caused in film rolls upon annealing, resulting in effective annealing of a large quantity of film rolls.

A third object of the present invention is to provide a method of winding a polymer film web into a film roll and a method of annealing the film roll, which can reduce the generation of conventional defects including sharp swelling, cut-end-mark and imprints of a core texture which occur in the core side part of the film roll and ruggedness caused in the periphery side part of the film roll, and which can reduce the generation of defects on a rolled film surface in a cooling step after the annealing treatment (such as telescoping, starring and wrinkles around the core).

The present invention provides a method of winding a polymer film web (7) around a cylindrical core (8), said method comprising the steps of:

- providing a winding chamber (2) enclosed with a heat insulating material (6) for surrounding the cylindrical core (8);
- heating the core (8) by blowing hot-air having a temperature of from 60°C to 140°C against the core (8); and
- winding the polymer film web (7) around the heated core (8) while blowing hot-air having a temperature of from 60°C to 140°C against the polymer film (7),

wherein the polymer film (7) comprises one of polyethylene terephthalate and polyethylene naphthalate, and

wherein the hot-air blow is controlled by a feedback system.

The above method may further comprise the steps of:

- transporting the wound polymer film into a thermostatic chamber while keeping the temperature thereof; and
- allowing the wound polymer film to stand for from 6 minutes to 1,500 hours in a thermostatic atmosphere having a temperature of from 60°C to 140°C.

The present invention further provides a heat treating method for annealing a film roll of a polymer film web wound around a cylindrical core, said method comprising the steps of:

- surrounding the film roll with heat insulating panels; and
- blowing hot-air against the film roll in the direction along the core axis while rotating the core intermittently or continuously at a rotary speed of from 0.04 to 4 revolutions per hour.

Additionally, the present invention provides a heat treating apparatus for annealing a film roll (12) of a polymer...
film web wound around a cylindrical core (15), said apparatus comprising:

- a flatcar (13) on which the film roll (12) is mounted;
- a heat insulating panel (14) which is arranged to form a chamber for surrounding the film roll (12) on the flatcar (13);
- a pair of rollers (16) which supports the core (15);
- a motor (17) which provides power for rotating the core (15) intermittently or continuously via the rollers (16); and
- a port (18) for introducing hot air into the chamber which is provided in one side of the chamber that faces one edge of the film roll (12).

Fig. 1 is a side elevation view of an embodiment of a winding chamber in which a winding apparatus is installed.

Prior to starting to wind a polymer film web, the temperature of a core for use in the winding is adjusted within the range of a heat treatment temperature ± 3°C by exposing the core directly to hot-air. When a web is wound onto a core having a temperature lower than the heat treatment temperature minus 30°C, thermal shrinkage by rapid cooling is caused in the web to generate surface defects such as wrinkles, scratches or ruggedness. When a web is wound onto a core having a temperature higher than the heat treatment temperature plus 30°C, the mechanical strength of the web decreases to generate defects such as elongation or scratches. By adjusting the core temperature to the range of a heat treatment temperature ± 30°C, the above described surface defects are prevented from arising.

The temperature at which the core is heated can be regulated by controlling the temperature and jet pressure of hot-air, and the distance between the tip of an air nozzle and the core. Subsequently, in winding a polymer film web into a film roll, the winding tightness can be controlled by the jet pressure of hot-air from another nozzle. The jet pressure of hot-air for heating ranges from 0.98 to 9.81 kPa (100 to 1,000 mmAq).

In the winding method of the present invention, a feedback system and an optional non-contact temperature sensor for detecting the periphery temperature of a film roll under winding are used; and thereby the temperature of hot-air from an air jet nozzle can be controlled to attain a temperature within the heat treatment temperature range of 60°C to 140°C. The controllable temperature range becomes within the heat treatment temperature range of 3°C or more. As a result, winding wrinkles and starring of a film roll occur.

A core and a film roll are heated in the winding chamber enclosed by a heat insulating material. In the winding chamber, other accessory apparatuses may also be installed. The heating temperature of a polymer film web upon winding operation ranges from 60°C to 140°C.

In the present invention, winding apparatus is installed in a winding chamber which encloses the minimum space necessary for surrounding the winding apparatus with a heat insulating material. In the winding chamber, other accessory apparatuses may also be installed. The heating temperature of a polymer film web upon winding operation ranges from 60°C to 140°C.

Furthermore, by winding a polymer film web while the film web is exposed to hot-air, stretching or contraction from the periphery side to the core side of a film roll can be reduced, and thereby starring of the roll and generation of winding wrinkles and winding ruggedness during the winding operation can be prevented. Accordingly, the thus ob-
A preferred embodiment of the winding chamber for use in the present invention is described in detail with reference to the accompanied drawing.

As shown in Fig. 1, a winding apparatus 1 is installed in a winding chamber 2 enclosed by a heat insulating material 6, and the interior of the winding chamber 2 is maintained at a temperature ranging from 60°C to 140°C. The interior temperature of the winding chamber 2 is appropriately selected depending on the material of a polymer film web to be wound up. For example, a suitable temperature for a polyethylene terephthalate film is from 60°C to 70°C, and that for a polyethylene naphthalate film is from 100°C to 120°C.

The heating inside the winding chamber 2 is carried out mainly with the hot-air blowing directly against a core and a polymer film web. In addition to these hot-air blow, a heater for conductive and radiant heating may be installed in the winding chamber 2, if needed.

A polymer film web 7 generally has a thickness of from 10 to 100 μm, a width of from 150 to 1,500 mm, and a length of from 1,000 to 3,000 m per film roll.

The cylindrical cores 8 are placed in the winding chamber 2, and each loaded on separate turrets of a winding apparatus 1. The core 8 is heated until its temperature is raised to from 60°C to 140°C by a hot-air blow which is heated in an air-heater 3 and discharged from a hot-air jet nozzle 5 arranged so as to keep a predetermined distance d from the core. In Fig. 1, reference numeral 4 represents a fun. Examples of the hot-air jet apparatus for use in the present invention include an apparatus described in JP-A-59-20746. The hot-air jet nozzle of the apparatus can be moved upward and downward, and the position thereof is adjustable.

A polymer film web 7 is brought into contact with heating rollers 9 before it is wound. The winding operation of the film web 7 is performed while the film surface is exposed to hot-air from another hot-air jet nozzle 5 arranged separately. Thus, the temperature distribution in a film roll 10 becomes uniform throughout the film roll 10 from the core side to the periphery of the film roll. In other words, local differences in the degree of thermal shrinkage and expansion are not produced in the film roll. Therefore, the film roll is free from winding wrinkles and winding ruggedness. Further, the winding tightness of a film roll is controllable by appropriately adjusting the discharge pressure of hot-air from the nozzle 5 by a damper 11.

As soon as the winding of the film web 7 into a film roll 10 is finished, the film roll is transferred from the winding chamber 2 into a thermostatic chamber (which is not drawn in Fig. 1) while keeping the temperature of the film roll. In this transfer step, the surface of the film roll undergoes a drop in temperature by exposure to the atmosphere of ordinary temperature. However, the drop in temperature arises in the zone extending from the periphery to the several turns. Therefore, the influence thereof is slight. In the thermostatic chamber, an annealing treatment is generally carried out for a period ranging from 6 minutes to 1,500 hours at a temperature ranging from 60°C to 140°C.

In the heat treatment method for annealing a film roll, the film roll is enclosed with heat insulating panels, which panels are arranged to form one chamber for surrounding the film roll, for enabling the surroundings to be heated as uniformly as possible and further ensuring the saving of heat. A hot-air duct is connected to the port, and the interior temperature of the winding chamber 2 is appropriately selected depending on the material of a polymer film web. In addition to these hot-air blow, a heater for conductive and radiant heating may be installed therein means rotating the core by dividing one round (360°) of the core into from 2 (180°) to 12 (30°) sections, and by interposing a standstill for some definite time between each divided rotates so that the core rotates at a rotary speed of from 0.04 to 4 revolutions per hour (abbreviated as "r.p.h.", hereinafter) as a whole. The ratio (R) between standstill time and rotating time may be from 0 to 20, preferably from 0 to 10. The continuous or intermittent rotation as described above enables the entire film roll to be uniformly heated. Furthermore, the uniform forced heating inhibit conventionally observed air leakage from spaces between films which is due to film shrinkage upon cooling. Therefore, the film roll is free from elliptical distortion and wrinkles. When the rotating speed is slower than 0.04 r.p.h., or when the ratio R is larger than 20, the film roll may suffer an elliptical distortion. On the contrary, when the rotating speed is faster than 4 r.p.h., the film roll is apt to suffer telescoping. Further, the combination of forced heating with the rotation of a film roll can prevent localization of heat, and can promote the annealing of the film roll. The blowing speed of hot air is preferably from 1 to 200 m/sec.

A preferred embodiment of the heat treatment apparatus for annealing a film roll of the present invention is shown in Fig. 2. The apparatus comprises a flatcar 13 on which a wound film roll 12 is mounted, heat insulating panels 14 for enclosing the film roll 12 mounted on the flatcar 13, a pair of rollers 16 which support a core 15 of the film roll 12, a motor 17 which provide power for rotating the core 15 of the film roll 12 via the rollers 16 at a speed of from 0.04 to 4 revolutions per hour, and a port 18 for connecting a hot-air duct thereto which port is provided in one of the panels 14 that faces one edge of the film roll 12. The heat-insulating panels may be arranged to form one chamber over a plurality of flatcars each having thereon
mounted a film roll. In this case, rollers 16 for each film rolls may be interlocked each other for being rotated by one motor, and the port 18 may be one common port.

[0036] The temperature in the annealing chamber is selected appropriately depending on the material of a polymer film to be annealed. For example, suitable annealing temperature for a polyethylene terephthalate film is from 60°C to 70°C, and that for a polyethylene naphthalate is from 100°C to 120°C.

[0037] The annealing treatment is preferably carried out as follows. A winding part is put in a chamber and thereby the annealing treatment is started in the chamber simultaneously with a winding operation as described in JP-A-7-195381. In this case, a further annealing treatment is carried out in the chamber surrounded by heat-insulating panels on a flatcar.

[0038] When a film roll having a width of 1,500 mm and a diameter of a wound roll of 700 mm is subjected to a heat treatment at the glass transition temperature of a web, annealing treatment is uniformly pervaded throughout the web by heat-treating over a period of about 120 hours while the film roll is rotated intermittently or continuously at a speed of from 0.04 to 4 r.p.h. by the motor 17 via the rollers 16. (As for the port 18, the purpose thereof can sufficiently be served with providing only one port.)

[0039] If the film roll 12 is not rotated upon heat treatment, some portions of the film roll come to have a lower temperature, and thereby the heat treatment at the glass transition temperature becomes impossible to result in frequent occurrence of conventional surface defects.

[0040] The heat treatment method of the present invention is a batch treatment carried out for every film roll or on every flatcar, and can achieve raid annealing treatment. Compared with conventional treatment methods wherein a large-sized thermostatic chamber is used as the space for annealing, it is therefore easy to respond to changes in the number of film rolls to be annealed.

[0041] Upon cooling after the annealing treatment, the web shrinks, but softening of the web in the cooling step is not remarkable. The annealed film roll can be sent for a next step while the temperature thereof is kept at the annealing temperature without via the cooling step after the annealing treatment. In this case, the film roll is gradually cooled during transportation, and thereby effects of inhibiting the film roll from starring and generating wrinkles are produced.

[0042] The unwinding operation for a next step after an annealing treatment, where the film roll is heated to be in a high temperature state, is preferably carried out while the web is still in a high temperature state, preferably before the web temperature is decreased by 20°C from its glass transition temperature. As a result, surface defects caused by shrinking of the film upon cooling, such as telescoping, starring wrinkles and wrinkles around a core, can be reduced. This is because the film roll as wound is avoided suffering from distortion due to film shrinkage arising from drop in temperature by cooling the film roll while unwinding, instead of cooling a film roll as it is in the rolled condition. Additionally, the term "a next step" as used herein means e.g. a step of coating a subbing composition or a step of cutting the film.

[0043] In the present invention, one or more of the above described methods and an apparatus may be used in combination as appropriately to prepare a photographic film support.

[0044] The present invention will be described in detail with reference to the following Examples.

**EXAMPLE 1**

[0045] A polyethylene naphthalate film roll having a width of 1,500 mm and a diameter of a wound roll of 700 mm is annealed at a temperature of 120°C over a 120-hour period by means of a heat treatment apparatus as shown in Fig. 2. The relation between the rotary speed of the film roll during the annealing treatment and occurrence of surface defects were examined. The results obtained are set forth in Table 1.

<table>
<thead>
<tr>
<th>Surface Defects</th>
<th>Rotating Speed of Film Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (r.p.h.)</td>
</tr>
<tr>
<td>Starring</td>
<td>○</td>
</tr>
<tr>
<td>Winding Wrinkles</td>
<td>○</td>
</tr>
<tr>
<td>Winding Ruggedness</td>
<td>×</td>
</tr>
<tr>
<td>Telescoping</td>
<td>○</td>
</tr>
<tr>
<td>Ununiformity in Heat Treatment</td>
<td>×</td>
</tr>
</tbody>
</table>

○: no occurrence
×: occurrence

[0046] As can be seen from Table 1, the heat treatment using the present method and apparatus was successful in
preventing surface defects such as starring, winding wrinkles and winding ruggedness which conventionally occur in a film roll upon annealing treatment of the balk roll, to thereby considerably reduce the loss due to the surface defects.

Furthermore, it has been proved that the present method and apparatus make it possible to prevent the localization of heat in the annealing treatment, to achieve a uniform and rapid heat treatment, and further to simplify a flatcar structure. In addition, it becomes easy to respond to changes in the number of film rolls to be annealed.

**Claims**

1. A method of winding a polymer film web (7), comprising one of polyethylene terephthalate and polyethylene naphthalate, around a cylindrical core (8), said method being characterized by comprising the steps of:

   providing a winding chamber (2) enclosed with a heat insulating material (6) for surrounding the cylindrical core (8);

   heating the core (8) by blowing hot-air having a temperature of from 60°C to 140°C against the core (8); and

   winding the polymer film web (7) around the heated core (8) while blowing hot-air having a temperature of from 60°C to 140°C against the polymer film (7),

   wherein the hot-air blow is controlled by a feedback system.

2. The method of claim 1, further comprising the steps of:

   transporting the wound polymer film into a thermostatic chamber while keeping the temperature thereof; and

   allowing the wound polymer film to stand for from 6 minutes to 1,500 hours in a thermostatic atmosphere having a temperature of from 60°C to 140°C.

3. A heat treating method for annealing a film roll of a polymer film web wound around a cylindrical core, said method being characterized by comprising the steps of:

   surrounding the film roll with heat insulating panels; and

   blowing hot-air against the film roll in the direction along the core axis while rotating the core intermittently or continuously at a rotary speed of from 0.04 to 4 revolutions per hour.

4. A heat treating apparatus for annealing a film roll (12) of a polymer film web wound around a cylindrical core (15), said apparatus being characterized by comprising:

   a flatcar (13) on which the film roll (12) is mounted;

   a heat insulating panel (14) which is arranged to form a chamber for surrounding the film roll (12) on the flatcar (13);

   a pair of rollers (16) which supports the core (15);

   a motor (17) which provides power for rotating the core (15) intermittently or continuously via the rollers (16); and

   a port (18) for introducing hot air into the chamber which is provided in one side of the chamber that faces one edge of the film roll (12).

**Patentansprüche**

1. Verfahren zum Wickeln einer Polymerfilmbahn (7), die entweder aus Polyethylen-terephthalat oder Polyethylen-naphthalat besteht, um einen zylindrischen Kern (8) herum, wobei das Verfahren dadurch gekennzeichnet ist,
dass es die folgenden Schritte umfasst:

Bereitstellen einer Wickelkammer (2), die in einem wärmeisolierenden Material (6) eingeschlossen ist und den zylindrischen Kern (8) umgibt;

Erhitzen des Kerns (8) durch Aufblasen von Heißluft mit einer Temperatur zwischen 60°C und 140°C auf den Kern (8); und

Wickeln der Polymerfilmbahn (7) um den erwärmten Kern (8) herum, wobei Heißluft mit einer Temperatur zwischen 60°C und 140°C auf den Polymerfilm (7) geblasen wird, und

wobei das Heißluftgebläse mit einem Rückführungssystem gesteuert wird.

2. Verfahren nach Anspruch 1, das des Weiteren die folgenden Schritte umfasst:

Transportieren des aufgewickelten Polymerfilms in eine thermostatische Kammer, wobei die Temperatur des- selben aufrechterhalten wird; und

Belassen des aufgewickelten Polymerfilms in einer thermostatischen Atmosphäre mit einer Temperatur zwi- schen 60°C und 140°C über einen Zeitraum von 6 Minuten bis 1500 Stunden.

3. Wärmebehandlungsverfahren zum Tempen einer Filmrolle aus einer Polymerfilmbahn, die um einen zylindrischen Kern herumgewickelt ist, wobei das Verfahren die folgenden Schritte umfasst:

Umschließen der Filmrolle mit wärmeisolierenden Platten; und

Aufblasen von Heißluft auf die Filmrolle in der Richtung entlang der Kernenachse und gleichzeitiges intermittie- rendes oder kontinuierliches Drehen des Kerns bei einer Drehgeschwindigkeit zwischen 0,04 und 4 Umdreh- hungen pro Stunde.

4. Wärmebehandlungsvorrichtung zum Tempen einer Filmrolle (12) aus einer Polymerfilmbahn, die um einen zylin- drischen Kern (15) herumgewickelt ist, wobei die Vorrichtung dadurch gekennzeichnet ist, dass sie umfasst:

 einen Plattformwagen (13), auf dem die Filmrolle (12) angebracht ist;

eine Wärmeisolierplatte (14), die so angeordnet ist, dass eine Kammer entsteht, die die Filmrolle (12) auf dem Plattformwagen (13) umschließt;

ein Paar Rollen (16), die den Kern (15) tragen;

einen Motor (17), der Energie erzeugt, um den Kern (15) über die Rollen (16) intermittierend oder kontinuierlich zu drehen; und

eine Öffnung (18) zum Einleiten von Heißluft in die Kammer, die auf einer Seite der Kammer vorhanden ist, die einem Rand der Filmrolle (12) zugewandt ist.

Revendications

1. Procédé d'enroulement d'une nappe de film de polymère (7) comprenant un du poly(téréphtalate d'éthylène) et du poly(naphtalate d'éthylène), autour d'une âme cylindrique (8), ledit procédé étant caractérisé en ce qu'il com- prend les étapes consistant à :

fournir une chambre d'enroulement (2) enfermée par un matériau isolant thermiquement (6) pour entourer l'âme cylindrique (8) ;

chauffer l'âme (8) en soufflant contre l'âme (8) de l'air chaud ayant une température de 60°C à 140°C; et

enrouler la nappe de film de polymère (7) autour de l'âme chauffée (8) pendant que l'air chaud ayant une température de 60°C à 140°C est soufflé contre le film de polymère (7).
dans lequel le soufflage de l'air chaud est contrôlé par un système de rétroaction.

2. Procédé selon la revendication 1, comprenant en outre les étapes consistant à :

- transporter le film de polymère enroulé dans une chambre thermostatique en maintenant la température de celui-ci ; et
- laisser au repos le film de polymère enroulé pendant 6 minutes à 1500 heures dans une atmosphère thermostatique ayant une température de 60°C à 140°C.

3. Procédé de traitement par la chaleur pour recuire un rouleau de film d'une nappe de film de polymère enroulée autour d'une âme cylindrique, ledit procédé étant caractérisé en ce qu'il comprend les étapes consistant à :

- entourer le rouleau de film avec des panneaux isolants thermiquement ; et souffler de l'air chaud contre le rouleau de film dans la direction le long de l'axe de l'âme en entraînant en rotation l'âme de manière intermittente ou en continu à une vitesse de rotation de 0,04 à 4 révolutions par heure.

4. Appareil de traitement par la chaleur pour recuire un rouleau de film (12) d'une nappe de film de polymère enroulée autour d'une âme cylindrique (15), ledit appareil étant caractérisé en ce qu'il comprend :

- un chariot à fond plat (13) sur lequel est monté le rouleau de film (12);
- un panneau isolant thermiquement (14) qui est disposé pour former une chambre pour entourer le rouleau de film (12) sur le chariot à fond plat (13);
- une paire de roulettes (16) qui supporte l'âme (15);
- un moteur (17) qui fournit la puissance pour entraîner en rotation l'âme (15) de manière intermittente ou en continu via les roulettes (16) ; et
- un orifice (18) pour introduire de l'air chaud dans la chambre qui est prévu dans un côté de la chambre qui fait face à un bord du rouleau de film (12).