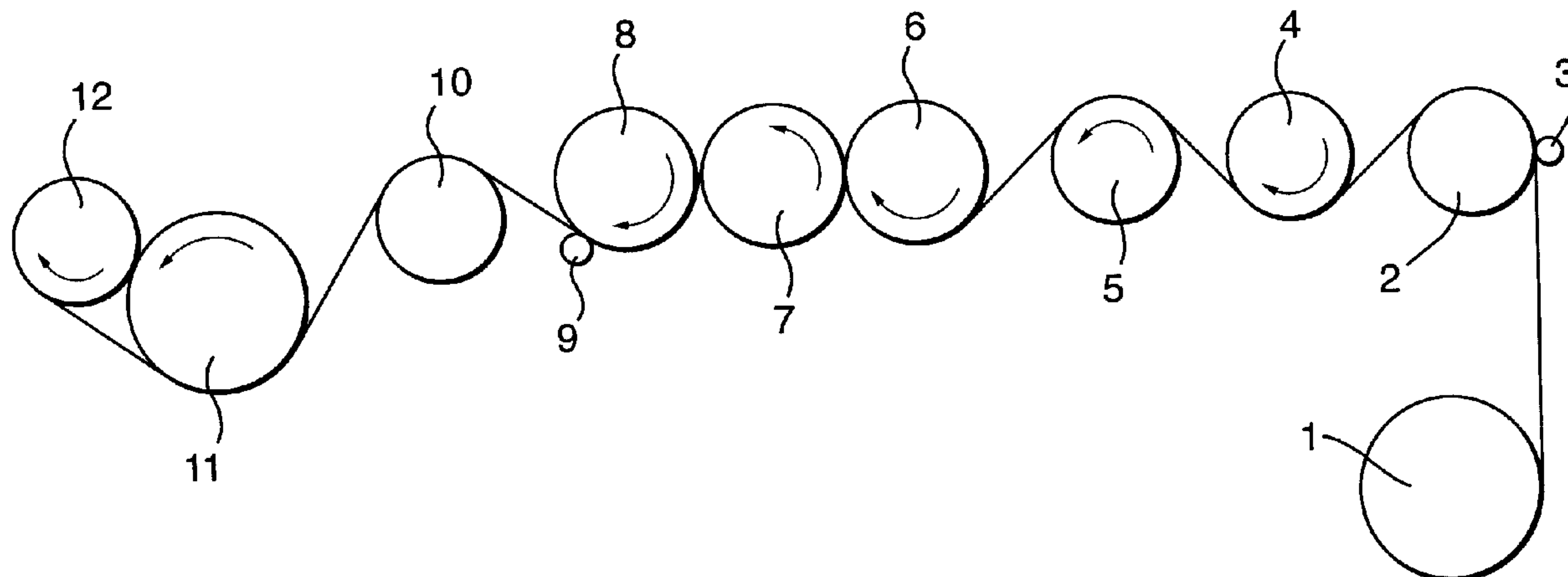




(22) Date de dépôt/Filing Date: 2001/02/06  
 (41) Mise à la disp. pub./Open to Public Insp.: 2001/08/09  
 (45) Date de délivrance/Issue Date: 2005/01/18  
 (30) Priorité/Priority: 2000/02/09 (00300989.1) EP

(51) Cl.Int.<sup>7</sup>/Int.Cl.<sup>7</sup> B29C 55/06  
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(54) Titre : PELLICULE D'EMBALLAGE ETIRABLE  
 (54) Title: STRETCH WRAP FILM



(57) **Abrégé/Abstract:**

A method of making a plastics stretch film comprises the steps of taking a cast or blown film of LLDPE at a temperature of between 50°C and 100°C, stretching it in two successive stretching steps, the first step having a stretch ratio higher than that of the second step, to cause both plastic and elastic deformation of the film. The film is then relaxed to substantially release all of the elastic deformation and winding the substantially relaxed film into rolls. Preferably, the first stretch ratio is in the range 1:1.70 to 1:1.80 and the second stretch ratio is in the range 1:1.85 to 1:1.95, and there is a reduction ratio of substantially 1:0.85 between the speed of the film during the second stretch rolling step and the speed of the film during wind-up.

**STRETCH WRAP FILM****ABSTRACT**

A method of making a plastics stretch film comprises the steps of taking a cast or blown film of LLDPE at a temperature of between 50°C and 100°C, stretching it in two successive stretching steps, the first step having a stretch ratio higher than that of the second step, to cause both plastic and elastic deformation of the film. The film is then relaxed to substantially release all of the elastic deformation and winding the substantially relaxed film into rolls. Preferably, the first stretch ratio is in the range 1:1.70 to 1:1.80 and the second stretch ratio is in the range 1:1.85 to 1:1.95, and there is a reduction ratio of substantially 1:0.85 between the speed of the film during the second stretch rolling step and the speed of the film during wind-up.

[FIG 1]

STRETCH WRAP FILMField of the Invention

The invention is related to stretch wrap films that are used extensively in packaging to package discrete units together to form a unitary package and are also frequently used to attach a package to a palette, for example. Stretch wrap film may also be used as wrapping to protect a commodity from the environment during handling and transport.

Background of the Invention

Stretch wrap may be applied by an automatic or semi-automatic machine which includes stretch rollers to pre-stretch the film before it is wrapped around a package. Alternatively the stretch wrap may be applied manually by applying the film from a roll supported on a simple hand-held mandrel. The present application has particular application to this latter category of stretch wrap material and also to film for use on machines in which the amount of stretch prior to wrapping is low or zero.

EP-A-0531021 published March 10, 1993, inventor - Shirrell, describes a process for producing a stretch wrap plastic film in which the film is "cold stretched" at ambient temperatures to thereby plastically and elastically stretch the film to cold orient it. The cold oriented film is then allowed to relax to recover substantially its elastic deformation before being formed into a roll. This arrangement provides a film wrap which is substantially as economical and may be more economical, in film usage when applied by a hand wrapping device than other stretch wrapping films are when applied by automatic and semi-automatic machinery including power pre-stretching devices. The process described in this patent specification has been commercially successful but, in practice, it has not been possible to achieve consistently as high a stretch ratio as 1:4 suggested in the patent specification without experiencing difficulties due to film breakage.

## Summary of the Invention

According to this invention a method of making a plastics stretch film comprises the steps of taking a cast or blown film of LLDPE at a temperature of between 50°C and 100°C, stretching it in two successive stretching steps, the first step having a stretch ratio higher than that of the second step, to cause both plastic and elastic deformation of the film, relaxing the stretched film substantially to release all of the elastic deformation and winding the substantially relaxed film into rolls.

Preferably, stretching is performed at a temperature of between 75°C and 90°C.

By having a film in the temperature range specified above and stretching it in two successive stages it has been found that it is possible to produce more consistently a pre-stretched film. The film also has advantages in having a clearer, less opaque appearance.

Preferably the stretching of the film that occurs in the two successive steps has a stretch ratio in a range from 1:1.5 to 1:2.5 for each step. More preferably, the first stretch ratio is in the range 1:1.85 to 1:1.95 and the second stretch ratio is in the range 1:1.70 to 1:1.80. Preferably during the relaxing step there is a reduction ratio of substantially 1:0.85 between the speed of the film during the second stretch rolling step and the speed of the film during wind-up.

Preferably the temperature of the stretch film is substantially 80°C during the stretching steps. The plastics film may be at this temperature by carrying out the stretching steps at an appropriate position downstream of a casting or blowing/extrusion production line so that the method in accordance with the present invention is carried out in line with the film production. Preferably however the method of the present invention is carried out, out of line with the basic film production process and in this case, the film is preferably reheated, for example by being passed over one or more heated rollers immediately before the stretching steps.

The plastics material particularly preferred for the stretch

film of the present invention is linear low density polyethylene (LLDPE). This material is a copolymer of ethylene with a C<sub>4</sub> to C<sub>10</sub> olefin; for example, butene-1, 3-methyl-butene-1, hexene-1, 3-methyl-pentene-1, 4-methylpentene-1, 3-methyl-hexene-1, octene-1, decene-1 or a mixture thereof. The alpha-olefin is usually present in an amount from 1 to 10 weight percent of the copolymer. A typical manufacturing process for the formation thereof is disclosed in USA-4076698 and 4205021. The preferred LLDPE has a density ranging from 0.900 to 0.940 g/cm<sup>3</sup>. This material preferably has a melt index of from 1 to 6. A multilayer film is also suitable, such as a multilayer film having a three layer A-B-C structure wherein the A layer comprises LLDPE, the B layer comprises metallocene LLDPE and the C layer comprises LMDPE.

#### Brief Description of the Drawing

A particular example of a process in accordance with this invention will now be described with reference to the accompanying drawing which is a diagrammatic illustration of the process.

#### Detailed Description of the Invention

A plastics stretch film of 17, 20 or 23  $\mu\text{m}$  thick material consisting of 100% LLDPE sold under the trade description 17, 20 or 23 UP 050 by Mima Films s.c.a. of 148 Route d'Arlon, L-8010 Strassen, Luxembourg is taken from a feed roll 1 through a nip formed between a first heater roller 2 and an idle roller 3. The film then passes around the top of heater roller 2, around the bottom of a heater roller 4 and around the top of a heater roller 5. All three heater rolls 2, 4 and 5 are provided with a recirculating supply of oil heated to 80°C. Heater rollers 4 and 5 are driven in opposite senses at a peripheral speed of 65 metres per minute. The heater roller 2 idles. As the film passes over the heater rollers 2, 4 and 5 it is heated to a temperature of 80°C. The heater rollers are formed from a material having a high heat conductivity. Chrome rollers have been found to be particularly effective.

The heated film then passes beneath a first rubber covered stretch roller 6 which has a peripheral speed of 66 metres per minute. A second rubber covered stretch roller 7 is located very close to stretch roller 6, 1 mm or less and is driven in the opposite sense to the first stretch roller 6 at a peripheral speed of 126 metres per minute. This stretches the film with a stretch ratio of 1:1.91, or 91% stretch. A third stretch roller 8 which is again located physically close to stretch roller 7 at a spacing of 1 mm or less is driven in the same sense as the first stretch roller 6 at a peripheral speed of 217 metres per minute. This stretches the film with a further stretch ratio of 1:1.72 or 72% stretch. An idler roller 9 creates a nip with the third stretch roller 8 to prevent slippage of the plastics film. As the film passes between the stretch rollers 6 and 7 and stretch rollers 7 and 8 it is stretched in two steps with a total stretch ratio of 1:3.3 or a stretch of 230%. The close proximity of the stretch rollers 6 and 7 and 7 and 8 prevent substantial necking-down of the plastics film material during its stretching.

The film leaving the nip between the third stretch roller 8 and the idler roller 9 then passes over a third idler roller 10 before passing around the surface of a polished roller 11 which has a peripheral surface moving in the opposite direction to the direction of movement of the film, before being wound on a core to provide an output roll 12 driven by being pressed against the surface of the roller 11. The roller 11 has a peripheral speed of 185 metres per minute and thus there is a difference ratio of 1:0.85 between the peripheral speed of the third stretch roller 8 and that of the wind up roller 12 which is sufficient to allow substantial relaxation of the film before it is wound up. Thus, the plastics film from the feed roller 1 is subjected to a total stretch of 1:3.3 followed by a relaxation of 1:0.85 leading to a total stretch ratio of 1:2.85. The typical thickness of the stretched output material is 6.8, 8 or 9  $\mu\text{m}$ .

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of making a plastics stretch film comprising the steps of:
  - a) taking a cast or blown film of LLDPE at a temperature of between 50°C and 100°C;
  - b) causing both plastic and elastic deformation of the film by stretching it in two successive stretching steps, said first step having a stretch ratio higher than that of said second step to form a stretched film;
  - c) relaxing said stretched film substantially to release all of the elastic deformation to form a substantially relaxed film; and
  - d) winding said substantially relaxed film into a roll.
2. The method of making a plastics stretch film as claimed in claim 1, wherein the temperature of said film is between 75°C and 90°C during said stretching steps.
3. The method of making a plastics stretch film as claimed in claim 2, wherein the temperature of said film is substantially 80°C during said stretching steps.
4. The method of making a plastics stretch film as claimed in claim 1, wherein the stretching of the film that occurs in said two successive steps has a stretch ratio in a range from 1:1.5 to 1:2.5 for each step.
5. The method of making a plastics stretch film as claimed in claim 1, wherein the stretching of the film that occurs in said first step has a stretch ratio in the range 1:1.85 to 1:1.95.
6. The method of making a plastics stretch film as claimed in claim 1, wherein the stretching of the film that occurs in said second step has a stretch ratio in the range 1:1.70 to 1:1.80.

7. The method of making a plastics stretch film as claimed in claim 1, wherein the stretching of the film that occurs in said first step has a stretch ratio in the range 1:1.85 to 1:1.95 and wherein the stretching of the film that occurs in said second step has a stretch ratio in the range 1:1.70 to 1:1.80.

8. A method of making a plastics stretch film comprising the steps of:

a) taking a cast or blown film of LLDPE at a temperature of between 50°C and 100°C;

b) causing both plastic and elastic deformation of the film by stretching it in two successive stretching steps, said first step having a stretch ratio higher than that of said second step, wherein during said second step said film is traveling at a first speed; and

c) relaxing said stretched film by winding said film into a roll at a speed 0.85 times said first speed.

9. The method of making a plastics stretch film as claimed in claim 8, wherein the temperature of said film is between 75°C and 90°C during said stretching steps.

10. The method of making a plastics stretch film as claimed in claim 9, wherein the temperature of said film is substantially 80°C during said stretching steps.

11. The method of making a plastics stretch film as claimed in claim 8, wherein the stretching of the film that occurs in said two successive steps has a stretch ratio in a range from 1:1.5 to 1:2.5 for each step.

12. The method of making a plastics stretch film as claimed in claim 8, wherein the stretching of the film that occurs in said first step has a stretch ratio in the range 1:1.85 to 1:1.95.

13. The method of making a plastics stretch film as claimed in claim 8, wherein the stretching of the film that occurs in said

second step has a stretch ratio in the range 1:1.70 to 1:1.80.

14. The method of making a plastics stretch film as claimed in claim 8, wherein the stretching of the film that occurs in said first step has a stretch ratio in the range 1:1.85 to 1:1.95 and wherein the stretching of the film that occurs in said second step has a stretch ratio in the range 1:1.70 to 1:1.80.

15. The method of making a plastic stretch film as claimed in claim 1 or 8, wherein the first stretching step comprises passing the film over a first rubber covered roller and then passing the film over a second rubber coated roller spaced no more than 1 mm from the first rubber covered roller and driven in an opposite sense to said first rubber covered roller.

16. The method of making a plastic stretch film as claimed in claim 15, wherein a peripheral surface speed of said first rubber covered roller is 66 meters per minute and a peripheral surface speed of said second rubber covered roller is 126 meters per minute.

17. The method of making a plastic stretch film as claimed in claim 15 or 16, wherein the second stretching step comprises passing the film over a third rubber covered roller spaced no more than 1 mm from the second rubber covered roller and driven in the same sense as the first rubber covered roller.

18. The method of making a plastic stretch film as claimed in claim 17 wherein a peripheral surface speed of said third rubber covered roller is 217 meters per minute.

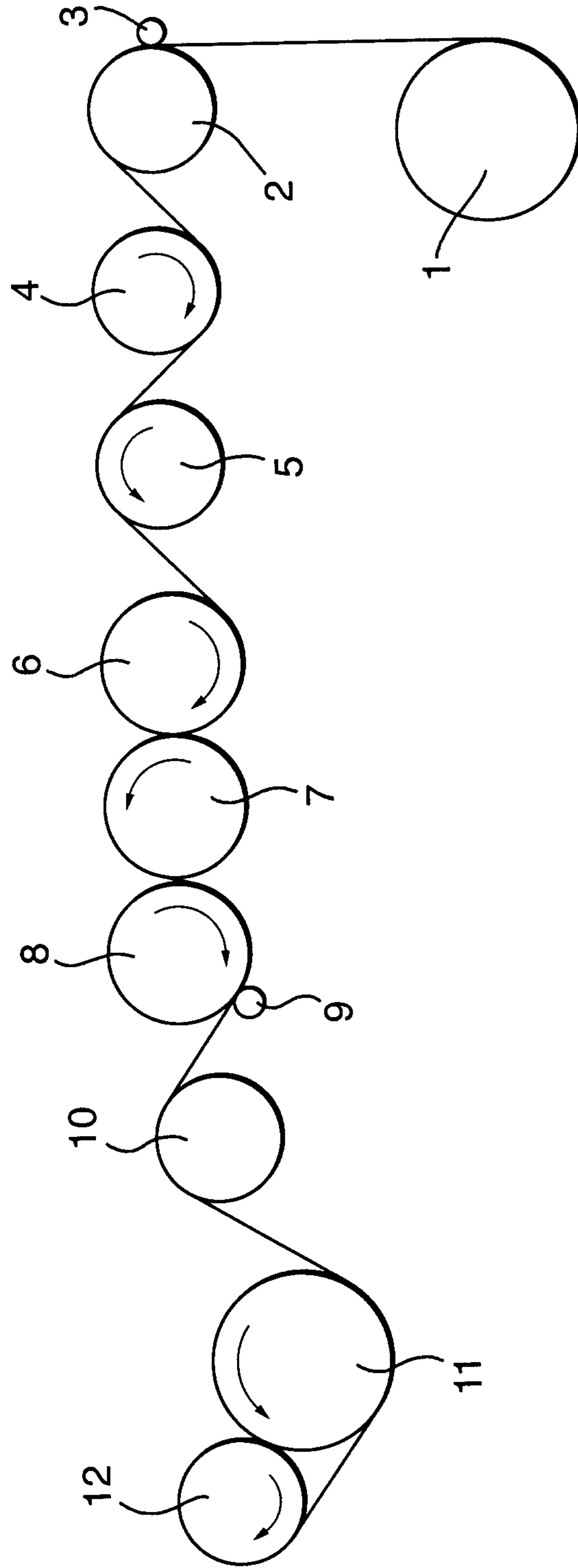


Fig. 1.

*Dulay & Singhal*  
PATENT AGENTS

