protective liner on the adhesive surface during conveying the material. Use of liners necessitates additional material and processing costs.

Many similar challenges and solutions are encountered with conveying rigid articles having exposed adhesive layers.

In order to provide desired end use performance, current trends include the use of pressure sensitive adhesives in relatively thicker coatings, pressure sensitive adhesives that are more aggressively tacky, have lower viscosity, etc. Such adhesive materials are more difficult to handling during manufacturing of the intended adhesive-sided product.

The need exists for improved methods and apparatus for conveying articles having an exposed adhesive layer.

Summary

Embodiments of the present invention provide a method for conveying a workpiece having a major surface with exposed adhesive and apparatus for carrying out the method. Embodiments of the present invention can be used with a variety of workpieces including long webs as well as sheets or other smaller discrete pieces.

Briefly summarizing, the method according to an aspect of the invention comprises:

(a) providing a workpiece having a first major surface having exposed pressure sensitive adhesive thereon;

(b) providing at least one transport roll having an engagement cover having an engagement surface comprising looped filaments that have a surface energy of less than about 30 dynes/centimeter^2;

(c) configuring the workpiece into passing configuration to the transport roll; and

(d) passing the workpiece through engaging contact with the engagement surface such that at least a portion of the pressure sensitive adhesive of the first major surface of the workpiece directly contacts the engagement surface wherein the pressure sensitive adhesive is tacky when in contact with the engagement surface.

In brief summary, another aspect of the present invention provides an apparatus for conveying a workpiece having a major surface with exposed adhesive, the apparatus comprising a transport roll comprising a core and an engagement cover having an engagement surface comprising looped filaments that have a surface energy of less than about 30 dynes/centimeter^2.

We have discovered that using such knits as engagement covers on transport rolls achieves an effective limited surface area and contact to an adhesive-bearing face in engaging contact therewith so as to attain desired transport roll effectiveness without expected disadvantages of fouling, degradation of adhesive, etc. Some of the surprising advantages provided by the present invention include significantly reduced manufacturing costs and higher yields. Use of transport rolls with engagement covers as described herein permit longer run times between shutdowns for clean up, permit faster run rates, and

eliminate the need for provision, installation, removal, and disposal of release liners. Use of such transport rolls in accordance with the invention permit changing production parameters (e.g., switching adhesive compositions, etc.) with reduced or eliminated retooling, leading to greater manufacturing efficiency and cost reduction.

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Brief Description of Drawing

The invention is further explained with reference to the drawing wherein:

Fig. 1 is a schematic cross section of an illustrative adhesive-sided workpiece with which the invention may be used;

Fig. 2 is a perspective schematic view of a portion of an illustrative embodiment of engagement cover of the invention (jersey knit with terry loop);

Fig. 3 is a photograph of a portion of an illustrative embodiment of engagement cover of the invention (jersey knit with terry loop);

Fig. 4 is schematic diagram of a portion of an illustrative embodiment of an apparatus of the invention;

Fig. 5 is a schematic diagram of an illustrative adhesive-sided web in engaging contact with a transport roll in accordance with the invention;

Fig. 6 is a photograph of a portion of one side of an illustrative engagement cover of the invention (warp knit tricot, also referred to as a French cross knit);

Fig. 7 is a photograph of a portion of the other side of the engagement cover shown in Fig. 6;

Fig. 8 is a schematic diagram of a portion of an illustrative French knit suitable for use as an engagement cover of the invention;

Fig. 9 is a schematic diagram of a portion of an illustrative terry loop knit suitable for use as an engagement cover of the invention (warp knit chain stitch diamond repeat);

Fig. 10 is a photomicrograph of a portion of a knit for use as an engagement cover of the invention; and

Fig. 11 is a schematic diagram of the apparatus used in the Examples.

These figures are not to scale and are intended to be merely illustrative and not limiting.

Key and Glossary

The following terms are used herein as having the indicated meaning; other terms are defined elsewhere in the specification.

"Convey" is used to mean moving a workpiece from a first position to a second position wherein the workpiece passes through engaging contact with a roll.

"Engaging contact" is used to refer to contact between the workpiece and the roll such that as the workpiece is conveyed it engages with the engagement cover of the roll compressing the cover in response to contact with the workpiece.

"Engagement surface" is the radially outwardly facing portion of the engagement cover that is directly contacted with the workpiece when the workpiece is conveyed.

"Engagement zone" is the portion of the engagement surface that is in direct contact with the workpiece at a particular moment. Depending upon the configuration, the engagement zone may range from merely substantially tangential contact (e.g., of a rigid workpiece such as an adhesive-coated piece of flooring) to an angular width (θ) of up to about 180° (e.g., of a flexible web workpiece that is conveyed around a roll to reverse its direction of movement).

Engagement Cover	Knit/Stitch	Composition		Terry Loop Height (mm)	Monofilament Diameter (mm)
		Loop	Base		
8	Semi-Pile Terry	FEP	150D PE	2.7	0.28
9	Semi-Pile Terry	FEP	70D PE	2.7	0.28
10	Full Pile Terry	150D PE	150D PE	1.5	NA
11	Full Pile Terry	400D PTFE	400D PTFE	1.5	NA
C1	NA	NA	NA	NA	NA
C2	NA	NA	NA	NA	NA

Full pile terry had a filament loop with every needle whereas semi-pile terry only had a filament loop at every other needle.

Experimental Apparatus and Method: The experiments were carried out using an Imass™ TL-2300 Slip/Peel Tester with a conveying apparatus attached thereto to create an interaction between an adhesive-coated workpiece and transport rollers.

As shown in Fig. 11, the apparatus 800 comprised a load cell 810 to which a flexible polyester strip 812 was attached and a drive screw driven platen 813 on which idler roll 814 and transport rolls 818 and 820 were mounted; idler roll 816 was mounted to the test body 800 and did not move with platen 813 and the other rolls. Strip 812 was wound around idler rolls 814 and 816. Intermediate to idler rolls 814 and 816 strip 812 was wound around two test transport rolls 818 and 820 which were each equipped with an engagement cover 822 and 824, respectively, as indicated below. A 5 centimeter (2 inch) wide adhesive tape 826 was mounted on one side of strip 812 to serve as a workpiece during the experiment with the adhesive face of the tape in passing configuration with each of engagement covers 822 and 824 on transport rolls 818 and 820, respectively. Only the bare opposing side of strip 812 contacted idler rolls 814 and 816. Rolls 814, 816, 818, and 820 were each 10 centimeter (4 inch) diameter aluminum rolls. The passing apparatus was configured such that the workpiece 826 passed through about a 90° wrap (angle θ in Fig. 5) with each engagement cover). A weight W, having a mass of 4.4 kilogram (2 pound), was attached to the end of strip 812 to impart line tension in the strip and workpiece 826 develop engaging contact of the adhesive face of workpiece 826 with each of engagement covers 822 and 824. Upon activation, platen 813 was driven in direction D to pull a length of strip 812 and workpiece 826 and convey a length of workpiece 826 past rolls 814, 816, 818, and 820.

For each tape, three tests were run, each at a rate of 30 centimeters (12 inches) per minute for a test period of 20 seconds. The measured peel force, representing the interaction between engagement covers and the adhesive on the workpieces was measured and is reported in the following tables.

What is claimed is:

1. A method for conveying a workpiece having a major surface with exposed adhesive, the method comprising:

(a) providing a workpiece having a first major surface having exposed pressure sensitive adhesive thereon;

(b) providing at least one transport roll having an engagement cover having an engagement surface comprising looped filaments that have a surface energy of less than about 30 dynes/centimeter^2;

(c) configuring the workpiece into passing configuration to the transport roll; and

(d) passing the workpiece through engaging contact with the engagement surface such that at least a portion of the pressure sensitive adhesive of the first major surface of the workpiece directly contacts the engagement surface wherein the pressure sensitive adhesive is tacky when in contact with the engagement surface.

2. The method of claim 1 wherein the engagement cover is a knit material.

3. The method of claim 2 wherein the knit is selected from the group of warp knits and weft knits.

4. The method of claim 2 wherein the engagement cover is selected from the group of terry loop knits and French cross knits.

5. The method of claim 1 wherein the engagement cover is a removable sleeve on the roll.

6. The method of claim 1 wherein the engagement cover comprises monofilament yarn.

7. The method of claim 6 wherein the monofilament yarn has an average diameter of from about 725 to about 1530 micrometers (about 3 to about 50 mils).

8. The method of claim 6 wherein the monofilament yarn has an average diameter of from about 125 to about 510 micrometers (about 5 to about 20 mils).

9. The method of claim 6 wherein the average diameter of the monofilament yarn is at least about 1.2 times the thickness of the pressure sensitive adhesive.

10. The method of claim 9 wherein the average diameter of the yarn about 2 to about 30 times the thickness of the pressure sensitive adhesive.

11. The method of claim 2 wherein the knit material has an average thread count in the range of from about 6 to about 12 needles/centimeter (about 15 to about 30 needles/inch).

12. The method of claim 11 wherein the knit material has an average thread count in the range of from about 8 to about 11 needles/centimeter (about 20 to about 28 needles/inch).

13. The method of claim 2 wherein the loops in the knit material have a radial spacing of from about 1000 to about 1250 micrometers (about 40 to about 50 mils).

14. The method of claim 2 wherein the loops in the knit material have an axial spacing of from about 1140 to about 1400 micrometers (about 45 to about 55 mils).

15. The method of claim 2 wherein the knit material comprises yarn selected from the group consisting of silicones and fluoroethylene polypropylenes.

16. The method of claim 1 wherein the looped filaments have a surface energy of from about 8 to about 25 dynes/centimeter^2.

17. The method of claim 1 wherein the workpiece is a web material.

18. The method of claim 17 wherein the web material is provided in roll form and configuring the web material into passing configuration comprises unrolling the web material.

19. The method of claim 17 wherein the web material is extruded or cast in line to be configured into the passing configuration without having been wound into roll form.

20. The method of claim 17 wherein the web material is provided in sheet form.

21. The method of claim 1 wherein the workpiece has a second major surface having exposed pressure sensitive adhesive thereon.

22. The method of claim 21 further comprising:

(e) providing a second one transport roll having an engagement cover having an engagement surface comprising looped filaments that have a surface energy of less than about 30 dynes/centimeter^2;

(g) passing the workpiece through engaging contact with the engagement surface of the second transport roll such that at least a portion of the pressure sensitive adhesive of the second major surface of the workpiece directly contacts the engagement surface of the second transport roll wherein the pressure sensitive adhesive is tacky when in contact with the engagement surface.

23. The method of claim 1 wherein the transport roll is selected from the group consisting of idler rolls and driven rolls.

24. The method of claim 1 comprising providing two or more transport rolls each having such an engagement cover and passing the web through engaging contact with the engagement surface of each transport roll such that the pressure sensitive adhesive directly contacts the engagement surface.

25. An apparatus for conveying a workpiece having a major surface with exposed adhesive, the apparatus comprising a transport roll comprising a core and an engagement cover having an engagement surface comprising looped filaments that have a surface energy of less than about 30 dynes/centimeter^2.