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(71) Applicant *(for all designated States except US)*: NATIONAL STARCH & CHEMICAL INVESTMENT HOLDING CORPORATION [US/US]; 501 Silverside Road, Wilmington, DE 19809 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: RODGERS, Anthony, Peter [GB/GB]; "Silver Birches", 23 Newton Lane, Newton, Rugby, Warwickshire CV23 0DZ (GB). MASSOUTIER, Jean, Bernard, Paul [FR/FR]; 792, rue Nationale, F–69400 Villefranche sur Saône (FR). CALMES, Thierry, Fernand [FR/FR]; 289, rue Désiré Walter, F–69400 Villefranche sur Saône (FR). LANE, Ronald, James [CA/FR]; 20, rue d'Essling, F–69003 Lyon (FR).

(74) Agent: SPENCER, Michael, D.; Bromhead & Company, 19 Buckingham Street, London WC2N 6EF (GB).

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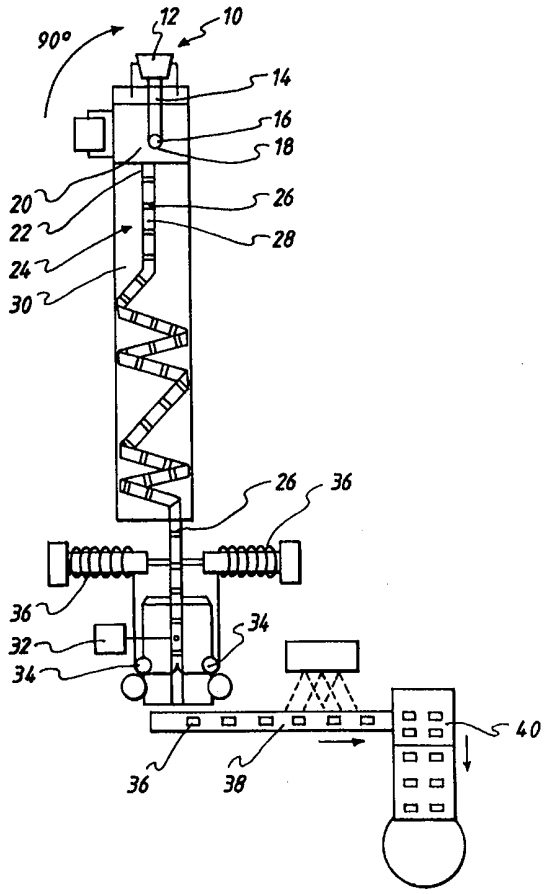
(54) Title: METHOD FOR PACKAGING OF HOT MELT ADHESIVES

(57) Abstract

A continuous method of producing hot melt adhesive comprising the steps of: a) forming a plastics material film tube (14) with the inside coated with a non–tack substance; b) pumping or pouring molten hot melt adhesive in liquid form into the tube (14); c) cooling the tube (14) with a cooling fluid; sealing the hot melt adhesive filled tube; d) voiding the tube (14) to produce a series of cartridges (28) of adhesive with the film (10) being substantially free of adhesive between each cartridge (28) thus produced; e) allowing the hot melt adhesive to solidify; f) cutting the film (10) coating on the adhesive tube (14); and g) stripping the film (10) from the hot melt adhesive.



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Method for packaging of hot melt adhesives

The present invention relates to a continuous method of packaging hot melt adhesive compositions and the resulting packaged adhesive composition.

Hot melt adhesives are generally applied while in the molten or liquid state, but are solid at room temperature. Typically, these adhesives are produced in the form of blocks and because of the nature of these materials, particularly the pressure sensitive hot melts, there are problems associated with handling and packaging them. These blocks not only stick or adhere to hands and/or mechanical handling devices and to each other but they also pick up dirt and other contaminates. Furthermore, when these blocks are placed in the melt pot in order to prepare application, such stickiness can often lead to dangers to the hands of human operators due to the adhesion of the block being added. There have been a number of previously proposed methods and devices for overcoming these problems.

US-A-4,054,632 proposes a method of continuously extruding hot melt adhesives under water, which adhesive upon extrusion

forms a skin. The extrusion is then cut into pillow shaped blocks by a cutter and the core of the thus produced block slowly allowed to solidify in a water bath. This method produces blocks of hot melt adhesives under clean conditions. However, it does not tackle the problem of handling the blocks of adhesive between production and use.

Subsequent to US-A-4,054,632 a number of methods have been proposed to coat hot melt adhesives with a non-tacky substance. A number of such methods, for example FR-A-2,801,618 and EP-A-0,748,673 propose lining a series of moulds with non-tacky substances and then pouring in the hot melt adhesive and then finally powdering or covering with a film the surface of mould to ensure complete coating of the blocks. All of these methods have the disadvantage that they require the use of cooled moulds and a large investment in such apparatus which is expensive to use and hard to automate.

EP-A-0,412,867 proposed a method of producing a continuous cord which is coated while being extruded. This method requires a considerable amount of hardware to ensure that both sides of

the flat sheet are coated and also does not adequately cope with coating the sides or edges of the sheets, leaving opportunities for contaminants to be picked up or for adhesion to handling apparatus and personnel.

A further method is proposed in EP-A-0,469,564 in which fragments of hot melt adhesive are held in a larger bag of a plastics material which can co-melt with the adhesive. This method enables different weights of bag to be produced. However, this method has problems with regard to the melting of the bag in the melt pot, in that the bag may not necessarily melt at the same time as the adhesive, resulting in the remains of the bag floating to the surface of the melt pot due to trapped air. The application describes overcoming this problem by evacuating the bag. However, this ignores the problem associated with handling such packages as they can easily be damaged with air seeping in leading to the same problems with the air in the bag. Furthermore this also requires the use of vacuum packaging equipment which adds to the cost of production. Therefore, this does not provide a suitable solution to the handling of hot melt

adhesives.

US-A-5,373,682 proposes a method of coating extruded hot melt adhesive with a non-tacky hot melt film. During the extrusion process the film which melts at a lower temperature than the hot melt adhesive is constantly sprayed with water or other coolant. The resultant extruded tube is then pinched, cut into separate cartridges and allowed to slowly cool for later use. This method while not having the co-melting problems of the plastic bags described above still results in the coating film being added to the melt pot.

WO-A-9700813 proposes modification of this method in which a string of such cartridges is held under water until the cartridges have cooled before cutting. This method is unnecessary to produce the appropriate technical result.

US-A-5,333,439 and US-A-5,392,592 propose further methods of producing a tubular film which coats an extruded string of hot melt adhesive. In US-A-5,392,592 such film is designed to co-melt with the hot melt adhesive. However, in US-A-5,333,439 the film is designed to be removed by hand before the block is added

to the melt pot. US-A-5,333,439 has the disadvantage that producing a coated silicon film is extremely difficult and therefore the block produced may not necessarily be coated with the non-tack substance leading to all the usual adhesion problems, and the crimping of the tube to produce blocks may not be successful.

It is an aim of the present invention to provide a method for producing hot melt adhesives which overcomes the above mentioned problems.

Accordingly the present invention is directed to a continuous method of producing hot melt adhesive comprising the steps of forming a plastics material film tube with the inside coated with a non-tack substance; pumping or pouring molten hot melt adhesive in liquid form into the tube; cooling the tube with a cooling fluid; voiding the tube to produce a series of cartridges of adhesive with the film being substantially free of adhesive between each cartridge thus produced; allowing the hot melt adhesive to solidify; cutting the film coating on the adhesive tube; and stripping the film from the hot melt adhesive.

This provides the advantage that films can be used which will not co-melt with the hot melt adhesive allowing a far wider choice of films which may be more durable and cheaper to produce. This also enables a wider choice of operating temperatures for the pumping of the hot melt adhesive. Thus allowing production to be run faster if higher temperatures are used. Furthermore, the film used can be removed in the factory and recycled. This also ensures that the surface of the hot melt adhesive is coated with a non-tacky substance which can be incorporated into the surface of the adhesive without any of the disadvantages of the aforementioned spraying techniques thus ensures that a small amount of coating is necessary. This provides the further advantage that the hot melt adhesive is produced in readily usable sized blocks. Furthermore, no film is present when the cartridge is placed in the hot melt pot thus removing the problems associated with the co-melting of the film and the hot melt adhesive.

Advantageously the plastics material tube is formed by wrapping the film around a mandrel and forming a seal such that

the seal is not inside the thus created tube. This provides the advantage that when the film is removed the hot melt adhesive does not retain any of the film inside it, nor does the removal of the film result in damage to the surface of the hot melt adhesive.

In the preferred embodiment the cutting of the film is conducted by cutting means which are on the opposite side of the tube to the seal.

Advantageously the film is wound off onto two spools as one side of the tube is cut, on the other the seal is pulled apart with the cartridge of hot melt adhesive ejected.

Advantageously the method includes the further step of cooling the string of cartridges by floating them in a fluid bath which is sprayed with cooling fluid from above. In the preferred embodiment the cooling fluid is one selected from the following list: water, cooled glycol, liquid or gaseous Nitrogen, compressed Carbon Dioxide. Preferably the cooling fluid is water. This has the advantage that the string of hot melt cartridges floats on the surface of the water allowing slow

consistent cooling of the hot melt adhesive.

Preferably the plastics material film is made from one or more of the following substances, polypropylene, nylon and polyurethane. This has the advantage that these film types are easy to produce and recycle and are readily coated with a non-tacky substance.

The method of the present invention is adaptable to the packaging of most types of hot melt adhesive composition. It is especially adapted to the packaging of thermoplastic or thermosetting pressure sensitive adhesives where the handling problems are most severe. As examples the method disclosed herein may be used to package hot melt adhesives prepared from polymers and copolymers of synthetic resins, rubbers, polyethylene, polypropylene, polyurethane, acrylics, vinyl acetate, ethylene vinyl acetate and polyvinyl alcohol. More specific examples include hot melt adhesives prepared from the following:

a. rubber polymers such as block copolymers of monovinyl aromatic hydrocarbons and conjugated diene, e.g., styrene-

butadiene, styrene-butadiene-styrene, styrene-isoprene-styrene, styrene-ethylene-butylene-styrene and styrene-ethylene propylene-styrene;

b. ethylene-vinyl acetate polymers, other ethylene esters and copolymers, e.g., ethylene methacrylate, ethylene *n*-butyl acrylate and ethylene acrylic acid;

c. polyolefins such as polyethylene and polypropylene;

d. polyvinyl acetate and random copolymers thereof;

e. polyacrylates;

f. polyamides;

g. polyesters;

h. polyvinyl alcohols and copolymers thereof;

i. polyurethanes;

j. polystyrenes;

k. polyepoxides;

l. graft copolymers of vinyl monomer(s) and polyalkylene oxide polymers; and

m. aldehyde containing resins such as phenol-aldehyde, urea-aldehyde, melamine-aldehyde and the like.

Most often such adhesives are formulated with tackifying resins in order to improve adhesion and introduce tack into the adhesive. Such resin include, among other materials, (a) natural and modified resins, (b) polyterpene resins, (c) phenolic modified hydrocarbon resins, (d) coumarone-indene resins, (e) aliphatic and aromatic petroleum hydrocarbon resins, (f) phthalate esters and (g) hydrogentated hydrocarbons, hydrogenated rosins and hydrogenated rosin esters.

Desirable optional ingredients include diluents, e.g., liquid polybutene or polypropylene, petroleum waxes such as paraffin and microcrystalline waxes, polyethylene greases, hydrogenated animal, fish and vegetable fats, mineral oil and synthetic waxes as well as hydro-carbon oils such as naphthionic or paraffinic mineral oils.

Other optional additives may include stabilizers, anti-oxidants, colorants and fillers. The section of components and amounts as well as the preparation thereof are well known in the art and described in the literature.

In a preferred embodiment the film is coated with a release

coating which integrates with the surface of the hot melt adhesive. This provides the advantage that the integration of the coating with the surface of the hot melt adhesive produces a non-tack coating for the adhesive. Furthermore, when the cartridges are produced the coating easily allows the film to be pinched together to create voids with little adhesive in it.

Preferably the coating is a Fischer-Tropsh wax. Advantageously the Fischer-Tropsh wax is Sasol H1™ wax. This provides the advantage that suitable wax coating can be selected which has improved non-tack characteristics whilst not being required to hold a string of cartridges together.

Preferably the voiding of the tube is carried out approximately perpendicularly to the direction of cutting of the film. Preferably the seal is of an upward fin type.

Preferably the film is multi-layered. This provides the advantage of giving the film considerably more strength in all directions.

Advantageously the film comprises two layers of polypropylene which are bonded together so that their lines of

weakness are perpendicular to each other. Advantageously the film can be tri-layered, comprising a sandwich of polypropylene, nylon, polypropylene which provides the advantage that nylon has considerable strength and gives the film considerably higher strength.

An example of an apparatus used to produce hot melt adhesive in accordance with present invention is shown in the attached drawing in which:

Figure 1 shows a schematic view of such an apparatus.

A coated film 10 is fed through a mandrel 12 in which the film 10 is fin sealed by a tack weld to form a tube 14. The tube 14 has the wax coating on its inside and has the seal on its outside. The film 10 may be coloured for instance blue or red, this aids checking that all the film 10 has been removed from the molten hot melt adhesive at a later stage. The tube 14 is fed through a heated injection machine 16 in which molten hot melt adhesive 18 is pouring into it at between 10 and 100psi at a temperature above the melting point of the film coating. The pressure of pouring of the hot melt adhesive defines the speed

of the film feed and is dependent on the adhesive being used. During the injection process the tube 14 can be constantly sprayed with water by spraying apparatus 20 which surrounds the tube 14. This ensures that if the plastics material of the tube 14 melts at a temperature lower than that of the melting point of the adhesive it does not melt. The tube 14 is then fed through a voider 22 in which two rollers 24 are hydraulically pressed together to create areas of the tube 14 where there is minimum adhesive, thus creating pillow like cartridges 28 of adhesive whose size is set by the time delay between each pressing. Rollers 24 are used as they avoid breaks in the tube 14. This is facilitated by the still semi-liquid state of the hot melt adhesive. Preferably the film seal is at approximately 90° to the rollers 24. The whole apparatus can still be constantly sprayed with water. The voider 22 can be adapted to create varying sizes of adhesive cartridge 28 depending upon customer requirements. A string 26 of cartridges 28 is then floated down a water bath 30 whilst its top surface is sprayed with water. The string 26 concertinas in the water bath 30 thus

allowing a greater use of the surface area of the bath 30 and thus requiring a smaller bath 30 for cooling the cartridges 28. The string 26 of cartridges 28 is then removed from the water bath 30 and passed through a high pressure water cutter 32 in which the jet of water cuts the film 10 on the top side of the cartridge 28, approximately opposite to the location of the fin seal. The water jet is at a pressure of between 200 and 500 bar, if too much pressure is used the jet forces the film 10 into the cartridge 28. Water cutters have the advantage that they follow the contours of the string of cartridges 28 with no physical contact. Other suitable cutting machines may be used such as lasers. The film 10 is then pulled off the cartridges 28 by rollers 34 which break at the fin seal on the uncut side of the cartridge and wound onto two winders 36 on either side. The speed of the winders 36 is the same as the speed of production. The cartridges 28 ejected from the string 26 and pass onto a conveyor 38 which is sprayed with water to wash away any surplus material. The cartridges 28 are finally passed through a dryer 40 before they are packaged for supply to a customer.

An example of hot melt adhesives that can be packaged using the method comprises the following percentage constituents by weight

20% Styrenic block copolymer e.g. SIS (Kraton D 1107) or Erichon Sol T166

60% Hydrocarbon resin or resin blend e.g. Escorez 5300. Kristallex 3115

19% Plasticiser e.g. mineral oil such as Odina 68.

1% Stabiliser package e.g. Irganox 1010, Polygard TNPP

An example of the film can comprise a sandwich with the following thicknesses: 25 micrometers of polypropalene on top of 15 micrometers of biaxial nylon on top of 47 micrometers of blue polypropalene with 20 micrometers thickness of Sasol H1 wax present. The film is coated with the wax across its entire width as the wax does not interfere with the fin seal when the tube is created. Another example of a film suitable for use with the present method comprises the following - 50 micrometers of blue tinted co-extruded polypropalene film, 44.9 grammes per square

meter, with 1.5 grammes per square meter of adhesive on top of 50 micrometers of blue tinted co-extruded polypropalene film which is orientated in a different direction to the top film at 44.9 grammes per square meter and coated with Sasol wax H1 at 20 grammes per square meter. This film is designed to withstand temperatures of 150°C without distorting.

CLAIMS

1. A continuous method of producing hot melt adhesive comprising the steps of

a) forming a plastics material film tube with the inside coated with a non-tack substance;

b) pumping or pouring molten hot melt adhesive in liquid form into the tube;

c) cooling the tube with a cooling fluid; sealing the hot melt adhesive filled tube;

d) voiding the tube to produce a series of cartridges of adhesive with the film being substantially free of adhesive between each cartridge thus produced;

e) allowing the hot melt adhesive to solidify;

f) cutting the film coating on the adhesive tube; and

g) stripping the film from the hot melt adhesive.

2. A method according to claim 1, in which the plastics material tube is formed by wrapping the film around a mandrel and forming a seal such that the seal is not inside the thus created

tube.

3. A method according to claim 1 or claim 2, in which the cutting of the film is conducted by cutting means which are on the opposite side of the tube to the seal.

4. A method according to any preceding claim, in which the film is wound off onto two spools as one side of the tube is cut, on the other the seal is pulled apart with the cartridge of hot melt adhesive ejected.

5. A method according to any preceding claim in which the method includes the further step of cooling the string of cartridges by floating them in a fluid bath which is sprayed with cooling fluid from above.

6. A method according to any preceeding claim, in which the cooling fluid is one selected from the following list: cooled glycol, liquid or gaseous Nitrogen, compressed Carbon Dioxide, water.

7. A method according to any preceeding claim, in which the plastics material film is made from any one of the following substances, polypropylene, nylon and polyurethane.

8. A method according to any preceeding claim, in which the film is coated with a release coating which integrates with the surface of the hot melt adhesive.

9. A method according to claim 8, in which the coating is a Fischer-Tropsh wax.

10. A method according to any preceeding claim, in which the voiding of the tube is carried out at approximately perpendicularly to the direction of cutting of the film.

11. A method according to any preceding claim, in which the seal is of an upward fin type.

12. A method according to any preceding claim, in which the film is multi-layered.

13. A method according to claim 12, in which the film comprises two layers of polypropylene which are bonded together so that their lines of weakness are prependicular to each other.

14. A method according to claim 12, in which the film is tri-layered comprising a sandwich of polypropylene, nylon, polypropylene.

15. A package of hot melt adhesive produced according to any of

the preceding claims.

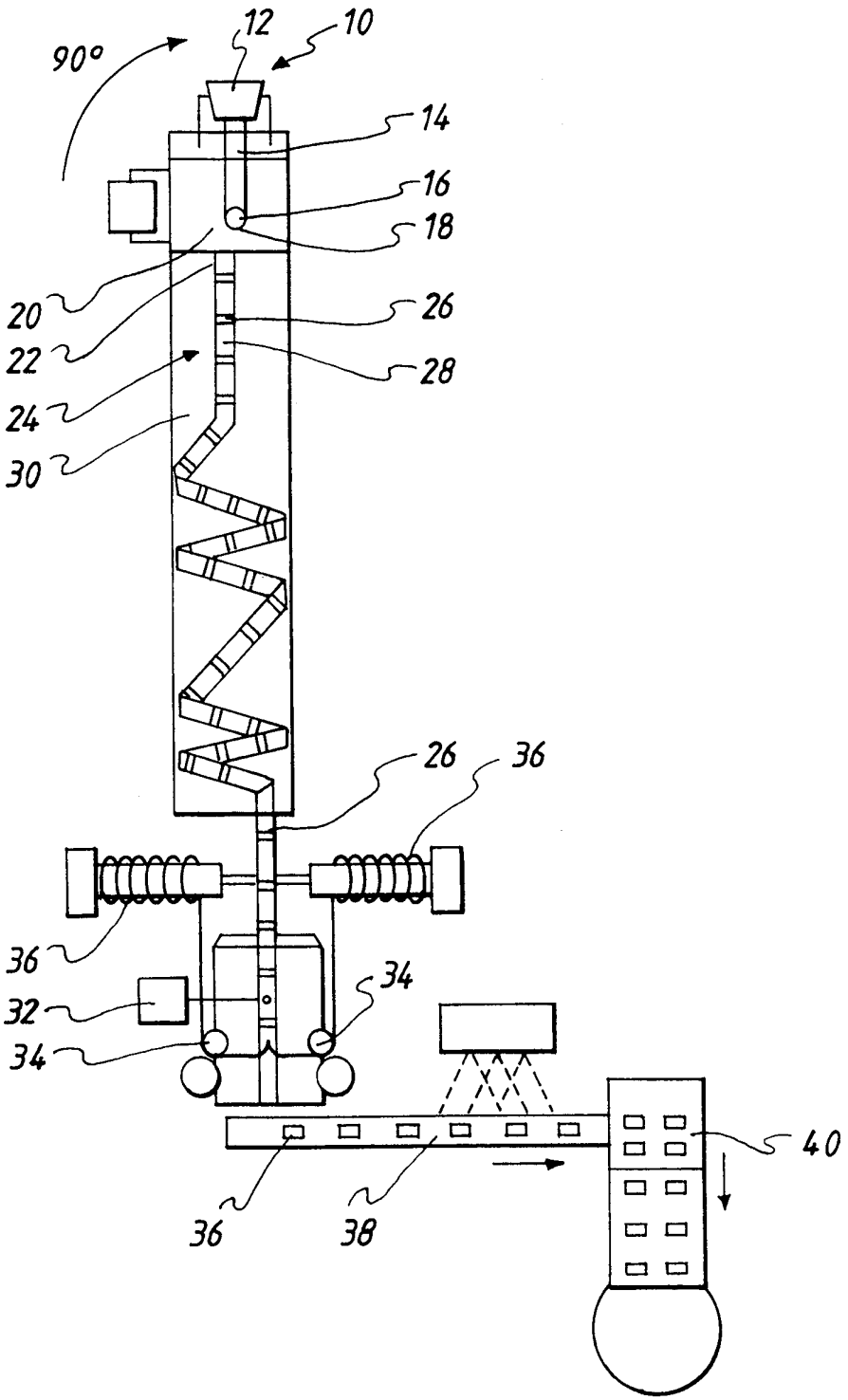

FIG.1

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65B63/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65B B29B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 222 346 A (NATEC) 29 June 1993 see the whole document	1,15
A	GB 1 137 649 A (ESSO) 27 December 1968	
A	DE 19 63 884 A (FORESTIER) 24 September 1970	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5222346 A	29-06-1993	DE 4204396 A	26-08-1993
		CH 686946 A	15-08-1996
		JP 2753784 B	20-05-1998
		JP 6008924 A	18-01-1994
GB 1137649 A		NONE	
DE 1963884 A	24-09-1970	CH 510551 A	31-07-1971
		NL 6919336 A	26-06-1970
		CH 502224 A	31-01-1971