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(54) Title: FOAMED ADHESIVES AND METHOD OF APPLICATION

(57) Abstract

A process for applying a non-uniform coating of foamed adhesive to a substrate, wherein a quantity of foamed adhesive is initially applied to the substrate, characterized in that a plurality of grooves are generated in the foam. The adhesive may comprise an aqueous emulsion of a latex and foaming agent, the adhesive preferably comprising a mixture of an anionic and an amphoteric surfactant.

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FOAMED ADHESIVES AND METHOD OF APPLICATION

The present invention relates to a foamed adhesive and a method of application of such a foamed adhesive. In particular, the present application relates to, for example, a hydrocarbon-foamed polychloroprene contact-adhesive and a process for applying a non-uniform coating of such an adhesive, for example by a comb, trowel or a roller, to a substrate. The invention further relates to a kit of parts for use in such a method of applying the foaming system.

Contact adhesives may be characterized by being coated onto both substrates to be joined and then being allowed to dry. There is a time window after the adhesive has dried during which the adhesive-coated substrates can be brought into contact and bonded. Contact adhesives are primarily used for laminate bonding. They are used both in industry and in the home.

Traditional contact adhesives are solvent-based. The products contain only 20% to 25% adhesive, the rest being composed of highly flammable solvent or chlorinated solvent vehicles which give off noxious fumes and are accordingly environmentally unfriendly. Aqueous contact adhesives were accordingly developed, wherein the adhesive is dispersed in a water base and spread uniformly over the surfaces to be contacted by way of a pad, brush or roller. However, aqueous adhesives have not been successful in the market place as they are not perceived to have the same bond strength as traditional solvent-based systems and suffer relatively long dry times.

It has now been discovered that foamed water-based

adhesives can be spread on a substrate with a comb, a trowel or roller to provide increased surface coverage per volume of product, whilst having a high bond strength and dry times at least comparable with traditional solvent-based systems.

US-A-3565247 discloses a pressure-sensitive adhesive tape, the adhesive layer of which is a foam system.

GB-A-2135903 discloses a foamed-sensitive adhesive layer having a stable foam structure prepared by mixing a gas comprising oxygen with an aqueous dispersion comprising an unsaturated polyester, a pressure-sensitive adhesive component and an accelerator effective for oxidative curing of the polyester.

US-A-4561918 discloses a foamed vinyl acetate-ethylene copolymer-based adhesive for use in the production of corrugated products.

US-A-4960802 discloses an aqueous compact composition for use as a contact adhesive which can be applied as a coating to the surface of two substrates and then foamed and dried to provide a dry cellular adhesive coating. The contact adhesive may be based upon, for example, acrylic, styrene-butadiene or chloroprene polymers. The cellular structure may be obtained by mechanically frothing the aqueous adhesive composition prior to coating, in which case the blowing agent is air, or by the addition of a physical blowing agent, for example a hydrocarbon. There is no disclosure of combing the foam before allowing it to dry.

It has now been discovered that if the foam is combed after application a stronger bond results than simply by joining two uncombed substrates. The foamed adhesive also has a long "window" time during which the substrates to be joined can be brought into contact. A much larger coverage is given in comparison with a non-foamed water-based adhesive whilst still maintaining the contact strength. The foamed adhesive according to the present invention is structurally time-stable. The cellular structure of the foam does not collapse. This maintains the "legging" of the foam for contact and also assists in evening out non-planar surfaces for complete adhesion.

The foam of the present product may be provided by an exterior foamer after application of the adhesive to the substrate, or, preferably, by an internal foamer.

The water-based adhesive composition for use in the present invention comprises an aqueous medium containing from 30 to 80 wt.% solid adhesive components, preferably 45 to 60 wt.%. The adhesive may be one known in the art, for example an acrylic, styrene-acrylic, styrene-butadiene, vinyl acetate, urethane or chloroprene polymer. The preferred aqueous adhesive copolymer emulsion for use in the foamable contact adhesive composition is a polychloroprene latex emulsion containing 50 to 60 wt.% solids.

The foamable adhesive according to the present invention will preferably comprise an anionic surfactant and an amphoteric surfactant. The anionic surfactant serves to create the surface tension conditions necessary

in the liquid to form the foam. The addition of an amphoteric surfactant has been found to produce a highly time-stable foam in the latex emulsion. The amphoteric surfactant also lowers the product viscosity. The surfactants may be present at a total of from 0.25 to 10 wt.% dry weight, preferably 1 to 5 wt.% dry weight. The ratio of anionic to amphoteric surfactant may range from 5:1 to 1:5 (as dry weight), preferably 1:3 to 3:1.

An internal-foamed system will contain from 1 to 10 wt.% of a foaming agent. Preferred foaming agents include halocarbons or hydrocarbons. Hydrocarbons such as butanes are preferred. Chemical blowing agents may also be employed, such as inorganic carbonates and inorganic bicarbonates.

The adhesive composition will preferably contain a tackifier such as a natural or artificial resin or derivative thereof. The tackifier is preferably a rosin ester emulsion and may be present at from 15 to 50% dry weight, most preferably 20 to 25% dry weight.

The foamable adhesive composition according to the invention may also contain other components such as fillers, acid acceptors, anti-oxidants, fungicides, bactericides, foam stabilizers and thickeners and perfumes.

The foamed adhesive may be applied to the substrates to be joined from a dispensing device such as a spray foam can and then spread over the surfaces of the substrates.

In another embodiment, the foamed adhesive is packaged

in a tub or lidded bucket. In use, portions of the adhesive may be spooned out of the open tub or bucket, dropped onto the substrates to be joined and then spread over the surface of the substrates.

A preferred method for spreading the foamed adhesive is with a scraper. A mound of foamed adhesive is applied to the centre of the substrate surface and then spread out over that surface. The scraper may be in the form of a combined scraper/comb. The scraper is used firstly to level the foam consistently over the surface, whilst a comb edge on the scraper generates grooves.

A further method of spreading the adhesive on the surface is with a roller. The roller may have a number of ridges which produce a combed affect as the roller is pulled or pushed across the foam. Though a roller ribbed perpendicular to the direction of roll is preferred, a roller ribbed parallel to the direction of roll may also be used. It has also been found that the foamed adhesive may be spread with a roller such as may normally be employed to spread coarse finish paints over a surface, the roller being sufficiently coarse to generate stipples of foam uniformly distributed over the contact area.

The adhesive system according to the present invention has a number of advantages over adhesives of the prior art. Firstly, since there is a very low level of inflammable material and since the adhesive system is water-based, the composition is non-flammable. The adhesive is also fire resistive and can assist in the manufacture of fire barriers. The low level of solvent also reduces noxious

smells and emissions.

The foam compositions of the present invention also have a fast drying time. For example, it has been shown that systems according to the present invention can take less than half the time of a conventional solvent-based adhesive to dry to a suitably "tacky" degree. However, a long contact window still occurs, e.g. 18 hours or more.

The compositions of the present invention show an increase in coverage compared to other products known in the art. A conventional solvent-based adhesive will have a coverage of about 5 square metres per litre. An aqueous adhesive will have a coverage of about 15 square metres per litre. In comparison, a foamed adhesive according to the present invention will have a coverage of about 30 square metres per litre of unexpanded product. It has been discovered that the strength of bonding is not worsened by the inclusion of a foam system. Indeed, the increased contact area of the crushed foam leads to a stronger bond.

The foam compositions of the present invention are structurally time-stable and do not collapse during drying. This assists in providing good contact between the surfaces to be joined.

The invention will now be described in further detail.

The following composition was prepared:-

	% Composition
Tackifier [1]	20.6
Zinc Oxide	2.8
Stabilizer	1.3
Antioxidant	1.3
Fungicide	0.2
Perfume	0.1
Polychloroprene Latex [2]	70.0
Amphoteric Surfactant	0.7
Anionic Surfactant	1.8
Foaming Agent	1.2

(1) A rosin ester emulsion

(2) An aqueous, colloidal dispersion of a polymer of 2-chlorobutadiene. The dispersion will contain 50%-60% solids.

The composition is loaded into a can. A foam applicator, similar to those known in the art, for example shaving foam cans, is attached. The can is shaken and a foam extruded onto the surfaces of the substrates to be joined.

The foam is then levelled over each surface using a scraper and then combed to generate grooves. The foam is then allowed to dry for from 5 to 20 minutes. The coated surfaces are brought into contact and pressed together.

The foam dries quickly, due to the retention of the foam structure, as water evaporates from the foam. The "bonding window" is thus open earlier than in an aqueous foam where amphoteric surfactant is not present. It is found that a string bond will be formed even after 24 hours drying.

Testing shows that the substrates are firmly bonded together, but can be repositioned when making the bond. Contact adhesives of the art are very hard to reposition.

The accompanying Figures show two devices for spreading and applying ridges to the foam.

Figure 1 shows a simple scraper which has a comb along one edge. The scraper is used first to level the foam consistently over the surface. Two spaces on the levelling edge facilitate this. The comb edge is then used to generate grooves.

Figure 2 shows a roller. This is run over the foam to both spread and groove the foam over the surface.

CLAIMS

1. A process for applying a non-uniform coating of foamed adhesive to a substrate, wherein a quantity of foamed adhesive is initially applied to the substrate, characterized in that the foam is structurally time-stable.

2. A process as claimed in Claim 1, characterized in that a plurality of grooves are generated in the foam.

3. A process as claimed in Claim 1 or Claim 2, wherein the foamed adhesive is generated as a foam from a container.

4. A process as claimed in any one of Claims 1 to 3, wherein the grooves are generated by means of a comb or a ridged roller.

5. An aqueous foamable contact adhesive composition comprising an aqueous emulsion of a latex and a foaming agent, characterized in that said adhesive further comprises an anionic surfactant and an amphoteric surfactant.

6. A composition as claimed in Claim 5, characterized in that the ratio of anionic to amphoteric surfactant ranges from 5:1 to 1:5.

7. A composition as claimed in Claim 5 or Claim 6, characterized in that said surfactants are present at from 0.25 to 10% dry weight.

8. A composition as claimed in any one of Claims 5 to 7, wherein the adhesive is an aqueous contact adhesive comprising an aqueous emulsion of an adhesive component selected from acrylic, styrene-acrylic, styrene-butadiene, urethane, vinyl acetate and chloroprene polymer.

9. A composition as claimed in any one of Claims 5 to 8, comprising a foaming agent selected from halocarbons and hydrocarbons.

10. A kit of parts for applying a non-uniform coating of foamed adhesive to a substrate which comprises a container containing an aqueous adhesive and a foaming agent; means for spreading the foam over the surface of the substrate; and a means for applying grooving to the spread form.

11. A kit of parts for applying a non-uniform coating of foamed adhesive to a substrate comprising a container containing a foamed adhesive; means for spreading the foam over the surface of the substrate; and means for applying grooving to the spread foam.

12. A kit of parts as claimed in Claim 10, wherein the means for spreading the foamed adhesive and the means for generating grooves in the foamed adhesive are combined into a single piece.

FIG. 1

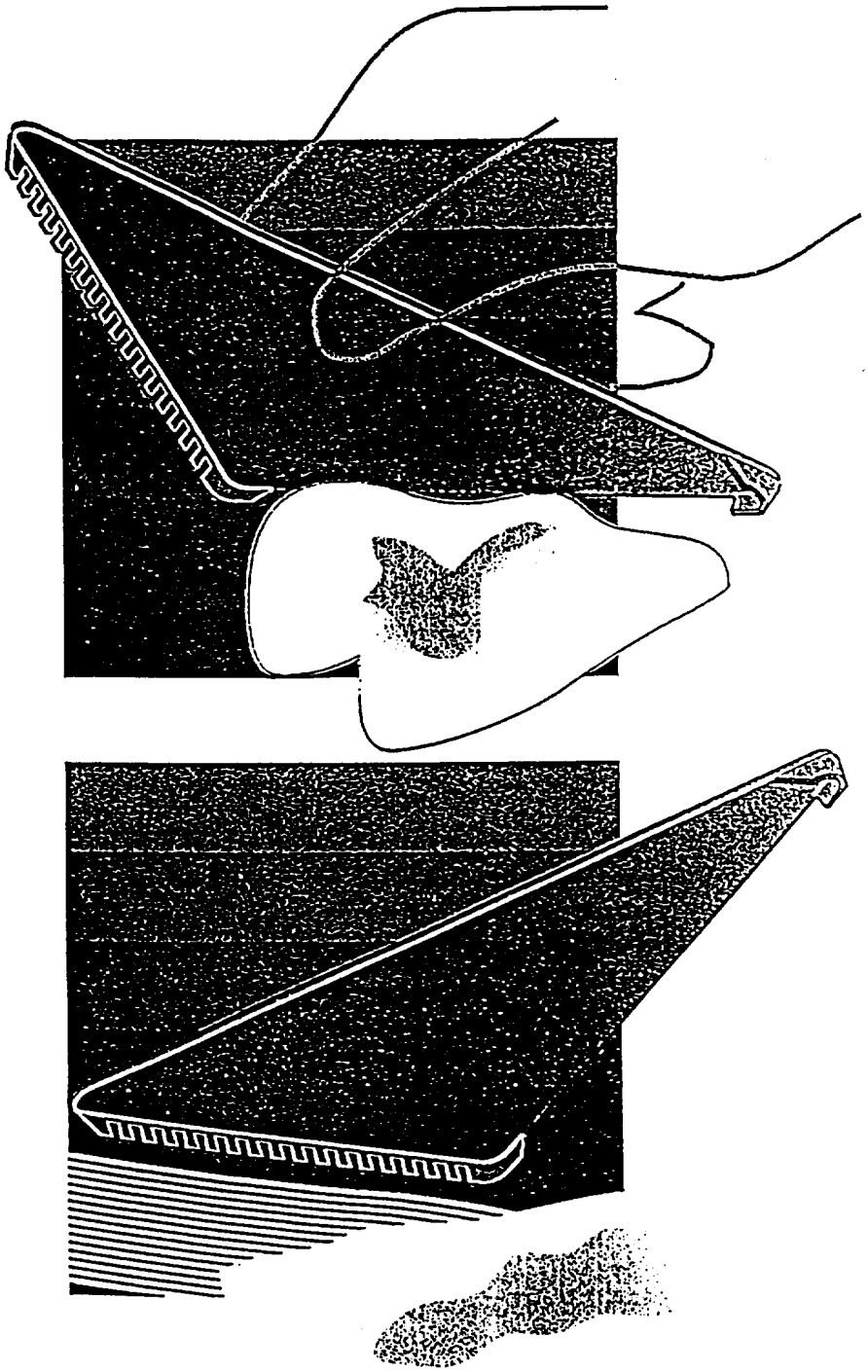
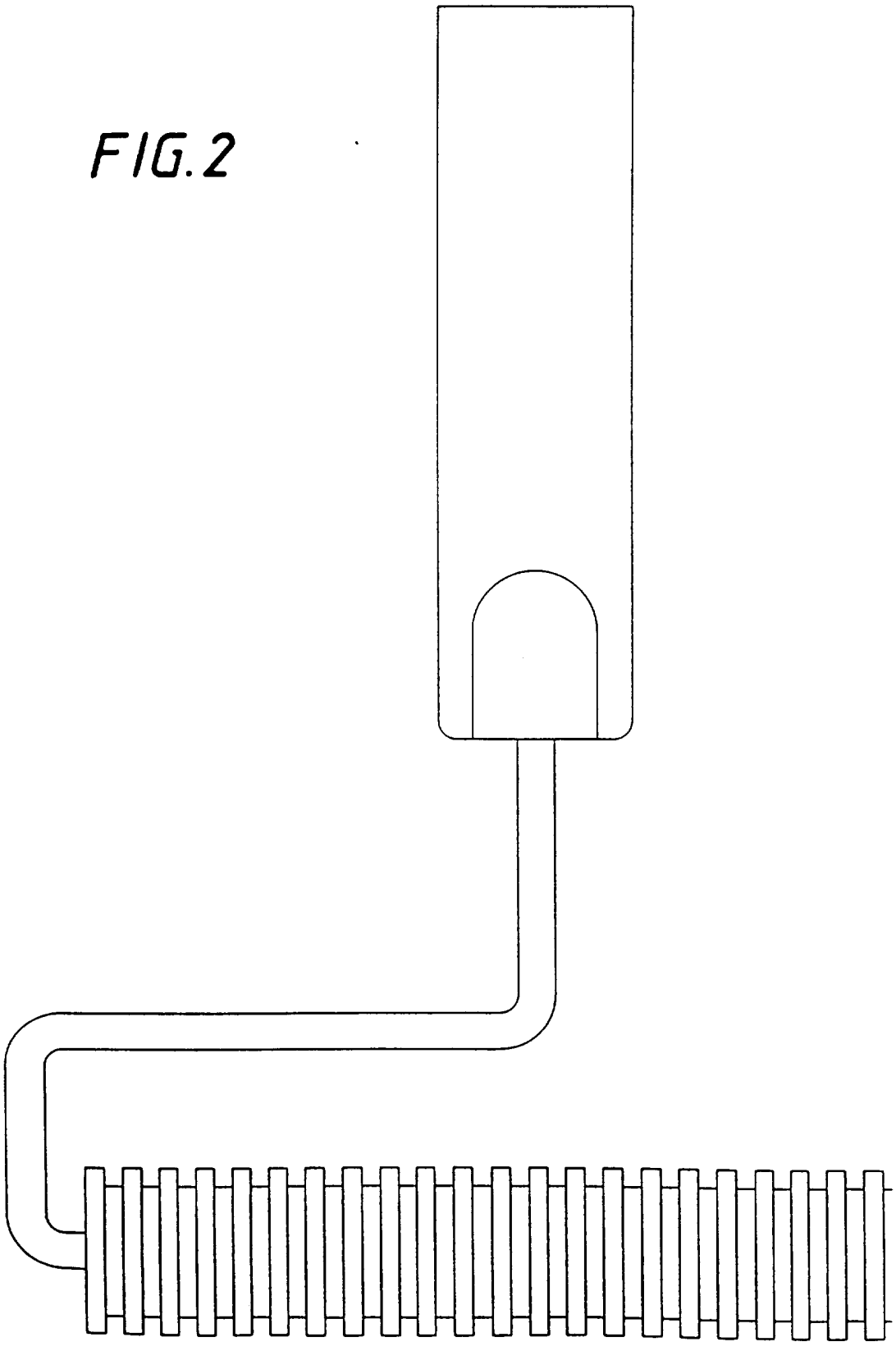


FIG. 2



INTERNATIONAL SEARCH REPORT

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PCT/GB 95/02550

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C09J5/08

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 C09J

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	GB,A,1 232 583 (BRENNAN, J. P.) 19 May 1971 see claims 1,3-5,11	1,5,8
A	US,A,4 960 802 (DISTEFANO, F. V.) 2 October 1990 see claims 1,6	1,5,9
A	DE,A,40 21 863 (BUCHTAL) 16 January 1992 see claims 1,5	1
A	DATABASE WPI Week 9233 Derwent Publications Ltd., London, GB; AN 92-272932 & JP,A,04 185 685 (MITSUI TOATSU) , 2 July 1992 see abstract	1,5

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

☒ Patent family members are listed in annex.

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