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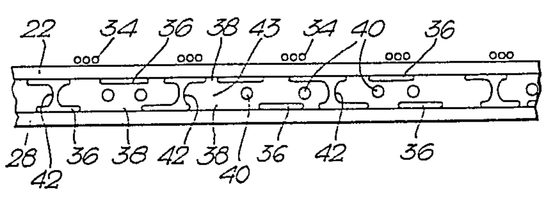
(54) **Wiping article.**

(57) A process for making a wiping article comprises distributing a heat-sealable, preferably meltable, material (36) such as polyethylene over at least one of two fibrous substrate layers (22,24), bringing the layers together so that the heat-sealable material (36) is at the interface between them, and also sandwiching surfactant (40) between the two layers. Energy is supplied to bond the two layers together but the heat-sealable material forms a discontinuous coating of one or both layers which are therefore bonded at a plurality of positions (42) distributed over the interface area. Hence the resulting article is water-permeable and the surfactant (40) can be released progressively when the article is wetted.

Fig. 3.



EP 0 353 014 A2

Description

WIPING ARTICLE

The invention relates to a wiping article suitable for use in cleaning soiled surfaces in the presence of water. The wiping article can be adapted for cleaning hard surfaces, particularly those to be found in the domestic kitchen and bathroom, or for cleaning the surface of the human body, for instance when taking a shower.

There have been a number of prior proposals for impregnated wiping articles for hard surfaces e.g. DE 2325176 (Schickedanz), EP 66463 (Unilever) and EP 211664 (Unilever). There have also been prior proposals for impregnated "cloths" for washing the human body surface, e.g. EP 68516 (Barbey & Hecken) and US 4303543 (Procter & Gamble). EP 161911 (Unilever) is relevant to both applications.

It has been proposed, e.g. in the above-mentioned EP 66463 and EP 211664, to provide a hard surface wiping article as a sandwich structure with first and second substrate layers sandwiching a core of concentrated surfactant.

It is known to unite the two layers of substrate by heat-sealing together in some form of regular pattern, for example a grid as in EP 66463 or an array of points as in EP 112654. Heat sealing is accompanied by applying heat and pressure only in the regions which are to be united, e.g. by passage between embossed rollers.

The present invention provides an alternative method of bonding two layers of substrate, in a manner which can be carried out simply and economically. Additionally, the invention provides a way to control the rate of dissolution of the surfactant, which can be useful in countering a problem of over-fast dissolution.

This problem can arise with both the above-mentioned categories of a wiping article: when used in the presence of a substantial quantity of water the soap or detergent active with which they are impregnated can be leached out too quickly, leaving the article prematurely exhausted of soap or detergent active. This might for instance be manifested as a hard surface wipe being exhausted after a single use, or a wipe intended for use under the shower failing to complete a single use.

EP 161911 proposed to delay release of impregnated detergent active compound by means of moisture barrier areas, applied in a pattern to sandwich detergent active applied in a similar pattern and retarding the leaching of the detergent active from the wipe.

Our EP 211664, mentioned above, proposed a wiping article for hard surfaces in which surfactant was trapped in a polymeric matrix material, thereby conferring controlled release properties.

According to a first aspect of this invention there is provided a process for making a wiping article suitable for use in cleaning soiled surfaces in the presence of water, the article comprising first and second substrate layers with surfactant sandwiched between the layers,

the process comprising providing water impermeable heat-sealable material distributed over or as part of the confronting surface area of at least one of the substrate layers with the material on at least one layer being a discontinuous coating of the surface area over which it is distributed, sandwiching surfactant between the confronting areas and supplying energy to these substrate layer areas with surfactant sandwiched between them thereby to bond the layers to each other at a plurality of positions distributed within and constituting only part of the areas to which energy is supplied. The heat-sealable material may be distributed over or be part of the confronting surface areas of both substrate layers or only one, provided the material on at least one layer is a discontinuous coating.

Supplying energy to bond the heat-sealable material may be application of ultrasonic or radiofrequency energy. Preferred however is application of heat and pressure to the substrate layer areas. Application of heat and pressure is of course the application of heat sealing conditions to heat-sealable material. However, it is not strictly "sealing" because it is heat-sealing at a plurality of distributed positions only.

It is preferred that the above-mentioned discontinuous coating covers less than 95% of the surface area over which it is distributed, e.g. between 25 and 90% of the surface area, more preferably between 40 and 75%. It is preferred that the heat-sealable material provides a discontinuous coating on confronting surface areas of both substrate layers. However, it is conceivable that the coating could be continuous on one substrate layer and discontinuous on the other substrate layer. Thus when there is heat-sealable material on both layers, it may possibly be 25 to 90% coverage of one layer and 25 to 100% coverage of the other. There may be not more than 90% coverage of the total surface area over which heat-sealable material becomes coated, possibly coverage is within a range from 30 to 75%.

The discontinuous coating may consist of localised coated zones which do not interconnect, or do so infrequently; alternatively it may be a foraminous or network-like coating.

It is strongly preferred that the surfactant is applied in a form which provides a discontinuous distribution of surfactant sandwiched between the substrate layers. For this purpose it is preferred that the surfactant is applied in the form of particles distributed over confronting surface area(s) of one or both substrate layers. Such particles may consist of surfactant alone, or surfactant absorbed onto a carrier.

In a preferred arrangement the heat-sealable material is a meltable bonding material applied in the form of particles distributed over confronting surface area(s) of one or both substrate layers. On heating, the particles can melt, spread out and bond onto the substrate layer material to form a coating. The coating can be made discontinuous by appropriate choice of the amount of meltable bonding material which is applied.

In a preferred arrangement both the meltable bonding material and the surfactant are applied in particulate form. A particularly preferred procedure is that at least one substrate layer has meltable bonding material distributed over a surface thereof, after which the substrate material is heated sufficiently to melt the bonding material so that it forms a discontinuous coating on that substrate layer. Surfactant particles are then distributed on the coated surface of at least one substrate layer, the layers are brought together sandwiching the surfactant material, and energy is supplied to join the substrate layers together. This is preferably accomplished by applying heat and pressure to join the substrate layers together.

In another aspect, this invention provides a wiping article suitable for use in cleaning soiled surfaces in the presence of water and comprising first and second substrate layers with surfactant sandwiched between the layers, in which article the substrate layers are bonded together by a water-impermeable heat-sealable material at the interface between the layers,
wherein both heat-sealable material and surfactant are distributed over at least an area of the interface, within which area the heat-sealable material bonds the substrate layers at a plurality of positions distributed over the whole of the said area but providing only part of the said area of the interface.

Generally the bonding at a plurality of positions will constitute an irregular pattern of bonding.

Preferably, the surfactant will be distributed in particulate form within the said area of the interface so that within the said area there are both particles of surfactant and bonding between the layers at a plurality of distributed positions.

It is also preferred that the heat-sealable material at the interface is a meltable material which covers one or both substrate layers with a discontinuous covering. More particularly it is preferred that the meltable material forms an incomplete layer between the surfactant and one or both substrate layers.

In this invention there is supply of energy to a sandwich including discontinuous heat-sealable material, thereby producing bonding at a plurality of positions. Preferably this takes place over the entire surface area of a wiping article. However it is feasible for it to be utilised over a lesser area, for example creating a regular grid pattern of bonding, with each line of the grid containing an irregular pattern of bonding at a plurality of distributed positions. The supply of energy is preferably application of heat accompanied by pressure.

As will be explained in more detail below the invention enables a wiping article to be manufactured by a process which is simple to carry out using available machinery. A further advantage is that the invention provides restriction of the rate of dissolution of the surfactant when the wiping article is brought into contact with water. By providing a coating on the confronting surfaces of the substrate layers, with this coating being an incomplete coating on at least one of the substrate layers, and then sandwiching surfactant between the coatings, an incomplete barrier is created between the surfactant and water permeating to the surfactant through one or both substrate layers. The barrier reduces the permeability through the substrate layer to the surfactant and thereby retards leaching of the surfactant. The extent to which permeability is reduced, and consequently the extent to which dissolution of the surfactant is retarded can be controlled by varying the proportion of the overall area which is covered by the incomplete coating. This may be varied by varying the amount of coating material applied and also the extent to which this material is heated, and thereby allowed to spread while in a molten state.

It was not to be expected that it would be possible to produce such an arrangement by application of heat and pressure (or otherwise supplying energy) to incomplete layers of heat-sealable material with surfactant between. We have found that bonding is achieved at a plurality of positions distributed over the area to which heat and pressure is applied but the bonding is interrupted by discontinuities of the coating on one or other layer and is also interrupted where particles of surfactant keep the materials separated. The overall effect is that the substrate layers are united, without losing their flexibility as would occur with bonding over their entire surface area, the surfactant is retained in place between the substrate layers, it is partially shielded from water penetrating to it through the substrate layers and yet it remains accessible to water. A small amount of surfactant may conceivably be entirely encapsulated by heat-sealing of water impermeable material around it but the amount of surfactant which is trapped in this way is not significant.

Materials Employed

The material of at least one substrate layer must be water permeable. Preferably the substrate layers are sheets of fibrous material.

Particularly preferred is a non-woven fibrous sheet. Cellulose fibres are particularly suitable in view of their ability rapidly to absorb water when employed to clean a soiled surface.

The substrate layers can also comprise other fibrous materials such as polyamide, polyester and polypropylene, or mixtures of such fibres, which are particularly useful in providing the article with extra wet strength.

The wet strength of substrate layer material can also be increased by incorporation of suitable binders such as styrene butadiene lattices, or an acrylic binder, or polyvinyl acetate, or polymer emulsions.

The absorbent substrate can be made from paper, in which case it will generally comprise cellulose fibres which are relatively short in length. Additives, such as hydroxyethyl cellulose may be employed to provide added wet strength.

The substrate layers may be the same or may be different. It can be advantageous to employ different substrate layers, for example choosing one substrate material to provide good wet strength and another substrate material to provide good absorbency. One preferred substrate material is a non-woven comprising cellulose fibres an example of which is Mitsubishi TCF 408, a 100% cuprammonium rayon spun bonded non-woven having the following technical specifications:

Nominal basis weight (g/m^2)	82.5
Thickness (µm)	500
Dry tensile strength: machine direction (N/m)	635
Dry tensile strength: cross direction (N/m)	565
Wet tensile strength: machine direction	498
Wet tensile strength: cross direction (N/m)	447
Absorption capacity (g/g)	5

Another substrate material is a non-woven comprising cellulose fibres such as Storalene 715:50 or Storalene 717:50 available from Stora-Kopparberg, Sweden, which contains the following ingredients:

	% per w/w
Cellulose fibres (wood pulp)	33
Cotton linters	29
Rayon	17
Polyamide	4
Binder*	17

*Storalene 715:50 contains an acrylic binder and Storalene 717:50 contains a polyvinyl acetate binder.

The relevant technical specification of Storalene 715:50 and Storalene 717;50 are set out below:

	Storalene	
	715:50	717:50
Nominal basis weight (g/m^2)	50	50
Thickness (µm)	400	365
Dry tensile strength-machine direction (N/m)	600	625
Dry tensile strength-cross direction (N/m)	450	330
Wet tensile strength-machine direction (N/m)	300	205
Wet tensile strength-cross direction (N/m)	250	95
Absorption capacity (g/g)	4	4

A further example of a suitable substrate material is Hi-Loft 3051 available from Scott Paper Co, a random wet-laid lofty paper web having a base weight of 82 g/m^2 and a porosity of 92%. This is bulky high-porosity sheet material having a high wicking rate.

It is possible for a substrate layer to consist of a laminate of more than one layer, for example a laminate of an absorbent material with a reinforcing material at the exterior surface. It is possible for abrasive particles to be applied to the exterior surface of one or both substrate layers. Suitable abrasive particles are polyvinyl chloride granules. The application of abrasive granules to the exterior surface of a wiping article is described in our published European application EP 211664.

Abrasive material may be applied to the exteriors of both substrate layers, and possibly different abrasive materials could be employed so that one substrate layer provided a harsher abrasive surface than the other. Preferable however is to have abrasive on one substrate layer and a smooth surface on the other substrate layer making it suitable for polishing off after initial cleaning with the abrasive side of the wiping article.

A possibility is to employ a discontinuous coating of the water-impermeable heat-sealable material on one substrate layer which has abrasive on its exterior, and to employ a heavier or continuous coating of water-impermeable heat-sealable material on the other substrate layer having a smooth surface. The consequence is that when the wiping article is wetted and used, surfactant will be released through the abrasive-bearing surface, preferentially.

Water-impermeable meltable heat-sealable material for bonding the substrate layers may be provided by a thermoplastic and in particular polyethylene may be used. If polyethylene particles are distributed on a non-woven fibrous substrate and heated they will melt, coat fibres at the surface of the substrate and spread laterally to form a coating of the substrate which, with a suitable quantity of polyethylene, will be an incomplete coating. Such sintering of polyethylene particles by heating is known per se. We have found it suitable to employ polyethylene beads having an average particle size in the range from 200µm to 500µm, especially an average of 300µm, and to apply them to a substrate layer in an amount from 5 to 200 g/m^2, preferably 10 to 170 g/m^2, more preferably 10 to 100 g/m^2. Both substrates may be loaded with polyethylene beads in amounts within the above ranges.

The surfactant which is employed may be chosen from the classes of anionic, nonionic, cationic and amphoteric surfactants. The surfactant is preferably employed in the form of solid particles and for this purpose it is preferred to employ surfactant which is a solid at ambient temperature so that particles of concentrated surfactant can be employed. Suitable anionic surfactants are dialkylsulphosuccinate, higher alkyl sulphates such as dodecyl sulphate and higher acyl isethionates such as cocoyl isethionates. Such surfactants are employed as salts with a solubilising cation, usually alkali metal, notably sodium. A further class of surfactants solid at room temperature and which may be employed are the sulphobetaines. Surfactants absorbed on a particulate carrier may also be employed.

A suitable range of sizes for particles of surfactant is a range from 0.1 to 1.0mm. Larger or smaller sizes may be employed but are not preferred. The loading onto wiping articles may lie in the range from 1 to 25 g/m^2.

An embodiment of the invention will now be described with reference to the accompanying drawings in which:

Fig. 1 is a diagrammatic representation of one stage in the production of wiping articles,

Fig. 2 is a diagrammatic representation of the next stage, and

Fig. 3 is an enlarged and very diagrammatic cross-section through a wiping article.

In the embodiment to be described one substrate layer consists of Mitsubishi TCF 408 and the other substrate layer consists of Hi-Loft 3051 both referred to above. In an initial step a web of Mitsubishi TCF 408 is printed on one side with parallel discontinuous lines of abrasive, approximately 0.5mm high and covering 25% of the surface area. The following composition was employed for this printing step.

Abrasive	Weight %
Polyvinyl chloride granules molecular weight 2 million, particle size 125-450 µm ex BDH Ltd	25
Vinamul 7172 (trade mark) latex adhesive ex Vinyl Products Ltd	40
Viscalex HV 30 (trade mark) thickener	4
Water, pigment	to 100

In the next step illustrated by Fig. 1, a web of substrate material 10 is drawn from a supply reel 12 and has sprinkled on to it polyethylene particles at a station 14. Apparatus for sprinkling polyethylene particles over the surface of a web is known; a suitable form of apparatus is available from Schaetti or Saladin - both Swiss manufacturers. The web with polyethylene particles thereon is then heated to the flow index temperature of the polyethylene by passing through an oven 16 or under an infra red lamp at a rate of 2m/min. Suitable polyethylenes for this purpose have flow indexes of less than 150°C. During this heating the particles melt and spread so as both to spread laterally and also to coat fibres at the surface of the substrate layer. The web leaving the oven is allowed to cool at 18 and then rewound at 20. This procedure is carried out both for the Mitsubishi TCF 408 previously printed with abrasive material and for the Hi-Loft 3051. In the former case the polyethylene particles are of course applied on the opposite side of the web to the abrasive material.

Next, as shown by Fig. 2 a web 22 of the thus-coated Mitsubishi TCF 408 is drawn from a reel 24 and surfactant particles are sprinkled onto the upper surface of the web which already bears the discontinuous polyethylene coat. This is carried out at a station 26 using similar apparatus as at the station 14 referred to above. A web 28 of Hi-Loft 3051 drawn from a reel 30 is applied over the web 22 of Mitsubishi TCF 408 so that the polyethylene coated surface of the Hi-Loft web 28 is on its underside and confronts the coated upper surface of the web 22 of Mitsubishi TCF 408 which is also carrying the surfactant. The sandwich so formed then passes through the nip of rollers 32, one of which applies sufficient heat to the Hi-Loft 3051 layer to effect bonding between the respective polyethylene coatings and join the two layers. The other one of the two rollers 32 is not heated. Suitable heated roller apparatus is available from Roaches Engineering, Leek, England; it can be used under the following conditions: 200°C at a nip pressure of 4 bar (60lbf/in^2) at a rate of 1 metre/min.

The web of sandwich material is then cut into wiping articles such as by means of web cutting equipment which is well known.

Fig. 3 is a diagrammatic cross-section through an area of such a wiping article. The layer of Mitsubishi TCF 408 is denoted as 22 and bears abrasive particles 34 on its exposed face. Reference 28 denotes the layer of Hi-Loft 3051. Polyethylene 36 provides a coating on each of these layers but is not a continuous coating. Discontinuities between zones of polyethylene are indicated at 38. Surfactant particles 40 are sandwiched between the layers. As indicated, there is heat-sealing joining the polyethylene on one layer with that on the other. This occurs at a plurality of irregularly spaced positions 42 but there can be no heat sealing where there is a match of discontinuities 38, as at 43, nor where there is a surfactant particle 40.

Example 1

A number of wiping articles were prepared in the manner shown in the drawings, except for using cut sheets of the substrate materials in place of webs.

Polyethylene beads of average particle size 300µm were applied to each substrate (Mitsubishi TCF 408 and Hi-Loft 3051 respectively) in a quantity of 2.5gm per 30cm x 30cm sheet, equivalent to 28gm/m^2.

For different wiping articles three surfactant materials were employed, at varying dosages. The surfactants employed were sodium dodecyl sulphate with average particle size 0.4mm, sodium di C_6 - C_8 alkylsulphosuccinate with average particle size 0.4mm and sodium cocoyl isethionate. This isethionate was used in several different particle sizes which were obtained by grinding and sieving commercial noodles of this surfactant. The particle size ranges were 0.18 to 0.35mm, 0.35 to 0.5mm, 0.5 to 1.0mm and 1.0 to 1.7mm. The surfactants were employed at dosages per article of 0.2, 0.5 and 1.0 gram per 28cm x 28cm square area of a wiping article. This is equal to 2.5, 6.4 and 12.8 g/m^2. Margins outside the 28cm x 28cm area were trimmed off after bonding the layers together.

In each case the wiping article produced was a sheet with satisfactory flexibility, and its two substrate layers securely held together. When wetted with water, and squeezed, the wiping articles exuded foam.

In the case of sodium cocoyl isethionate having a particle size in the range 1.0 to 1.7mm, the amount of foam was somewhat inadequate when using only 0.2g of surfactant per wiping article.

Example 2

In order to demonstrate that permeability could be controlled by the amount of sintered polymer used for sealing, the following experiment was carried out.

Various loadings of polyethylene beads of average particle size 300µm were sprinkled onto sausage casing (J R Crompton Plc, Elton Paper Mill, Bury, Lancashire) and were passed under an infra red lamp as described above. Crompton Sausage Casing is a cellulosic non-woven material of similar structure to Mitsubishi TCF 408, but having a lower base weight (21g/m^2) and hence higher initial permeability, facilitating a wide range of flow conditions.

Sample discs were cut from the treated web, and subjected to a constant pressure head of water. The flow rate through the disc was measured and the values obtained are set out below.

Weight of polyethylene beads per unit area (gm/m^2)	Flow rate through sample (ml/sec)
47	12.1
74	9.6
144	6.6
152	6.9
164	5.9
228	5.8

Example 3

Wiping articles were prepared in the manner shown in the drawings but using 30cm x 30cm cut sheets of substrate material in place of webs (as was also done in Example 1).

Both substrates were Mitsubishi TCF 408. Polyethylene beads of average particle size 300µm were applied to each substrate in various quantities. The surfactant employed was sodium cocoyl isethionate employed at a dosage of 0.5 gram per 28cm x 28cm area of a wiping article, equal to 6.4 g/m². This consisted of 0.4 gram with a particle size range of 0.5 to 1.0mm mixed with 0.1 gram of particle size range 0.18 to 0.35mm. After bonding the layers together, margins outside the 28cm x 28cm area were trimmed off.

At the lowest loading of polyethylene beads, (5.6 g/m² on each side) the wiping articles were usable, but some separation of the two substrate layers was observed. At the highest loading of polyethylene beads the wiping articles were stiff and hard to squeeze. At all the intermediate loadings of polyethylene beads the wiping articles were completely acceptable, with satisfactory flexibility and the two substrate layers securely held together.

The wiping articles were tested by a procedure to determine the number of times they could be wet and squeezed out before becoming exhausted of surfactant. This test was carried out as follows. 25g of water (tap water of approximately 10° French hardness at a temperature of 35- 40°C) was poured on to a wiping article which was then squeezed, thereby squeezing out approximately half the water from the article. The water squeezed out was poured into a 100ml measuring cylinder and shaken for 5 seconds. Any surfactant dissolved from the wiping article would cause foaming. A foam volume greater than the volume of liquid in the measuring cylinder after standing for two minutes was regarded as adequate foaming. The procedure was repeated until the observed foaming ceased to be adequate. The number of cycles of wetting and squeezing out in this fashion before foaming ceased to be adequate are set out below.

Polyethylene loading per side (g/m²)	Cycles to Exhaustion	Comments
5.6	8	Some separation of layers
11	8	Completely acceptable
44.5	10	Completely acceptable
89	10	Completely acceptable
178		Article stiff and hard to squeeze

Example 4

Wiping articles were made and tested in the same manner as in Example 3 except that one substrate was Hi-Loft 3051 loaded with 28 g/m² of polyethylene beads while the other substrate was Mitsubishi TCF 408 with various loadings of polyethylene beads, or none at all except around a border of the layer so that only the polyethylene on the Hi-Loft 3051 was used to unite the two substrates over their main area.

When there was no polyethylene on the TCF side (except at the border) the articles were usable and it was apparent that there was bonding over the full area. With all the loadings of polyethylene on the TCF side, the articles were completely acceptable. The results observed are set out below.

Polyethylene loading on TCF side (g/m²)	Cycles to Exhaustion	Comments
11	10	Completely acceptable
44.5	10	Completely acceptable
89	10	Completely acceptable

Claims

1. A process for making a wiping article suitable for use in cleaning soiled surfaces in the presence of water, the article comprising first and second substrate layers with surfactant sandwiched between the layers,
the process comprising providing water-impermeable heat-sealable material distributed over or as part of the confronting surface area of at least one of the substrate layers with the material on at least one layer being a discontinuous coating of the surface area over which it is distributed, sandwiching surfactant between the confronting areas and supplying energy to these substrate layer areas with surfactant sandwiched between them thereby to bond the layers to each other at a plurality of positions distributed within and constituting only part of the areas to which energy is applied.

2. A process according to claim 1 wherein the heat-sealable material is distributed over the confronting surface areas of both substrate layers.

3. A process according to claim 1 or claim 2 wherein the surfactant is applied in the form of particles distributed over confronting surface area(s) of one or both substrate layers.

4. A process according to any one of the preceding claims wherein both a meltable heat-sealable material and the surfactant are applied in particulate form.

5. A process according to any one of the preceding claims wherein the heat-sealable material is meltable bonding material distributed over a surface of at least one substrate layer, the substrate material is heated sufficiently to melt the bonding material so that it forms a discontinuous coating on that substrate layer, surfactant particles are distributed on the coated surface of at least one said substrate layer, the layers are brought together sandwiching the surfactant material, and energy is supplied to join the substrate layers together.

6. A wiping article suitable for use in cleaning soiled surfaces in the presence of water and comprising first and second substrate layers with surfactant sandwiched between the layers, in which article the substrate layers are bonded together by a water-impermeable heat-sealable material at the interface between the layers,
wherein both heat-sealable material and surfactant are distributed over at least an area of the interface, within which area the heat-sealable material bonds the substrate layers at a plurality of positions distributed over the whole of the said area but providing only part of the said area of the interface.

7. An article according to claim 6 wherein the heat-sealable material is an incomplete layer of meltable material between the surfactant and one or both substrate layers.

8. A process or wiping article according to any one of the preceding claims wherein the heat-sealable meltable material is a thermoplastic.

9. A process or wiping article according to any one of the preceding claims wherein at least one substrate layer is a sheet of fibrous material.

10. A wiping article according to claim 9 wherein the fibrous material is non-woven.

Fig.1.

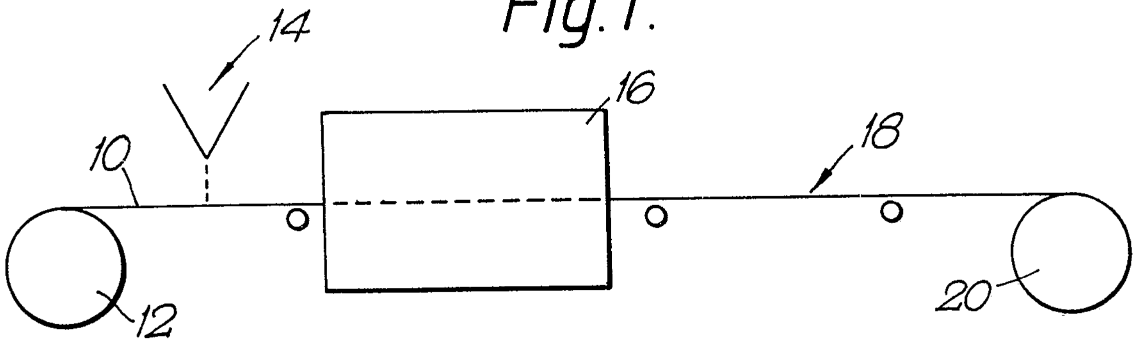


Fig.2.

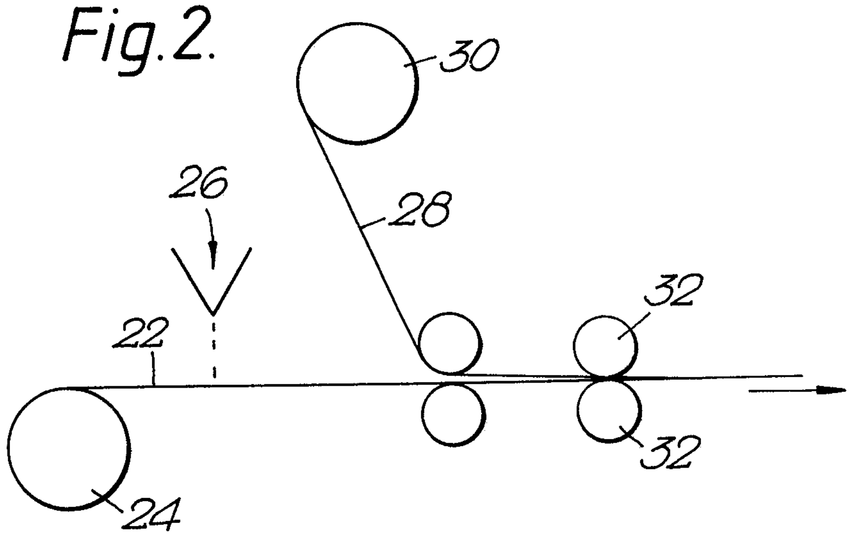


Fig.3.