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Production and Application of Linerless Labels

Background of Invention

A standard pressure sensitive label stock material has a multi-laminate structure composed of four critical elements: a face or face-stock (typically a paper or film), an adhesive (typically a pressure sensitive adhesive), a release liner system, commonly comprising a silicone coating on a paper or polymeric liner. This label stock, which is commonly produced in roll form, is converted into individual labels, which may then be applied to an article by an end-user, via the following typical process steps:

i. the face is printed with information and graphics, commonly describing and advertising the product contained within the article to be labelled. This printing is typically done on a continuous (roll-to-roll) narrow web press producing many labels across and along the web of the label stock.
ii. the upper parts (face and adhesive) of the label stock material are then die-cut, to produce individual labels carried in roll form supported by the release liner. Typically, but not necessarily, the die-cutting is performed on the same asset as that used to print the labels.
iii. the printed die-cut label stock is then slit to provide single lanes of labels and these slit rolls are then sent to an end-user who will affix the labels to articles via a dispensing process described in iv. below.
iv. labelling occurs at the end user by feeding the die-cut label stock to a dispensing machine wherein labels are removed one at a time from the release liner and applied to the articles to be labelled. The release system allows the adhesive-backed labels which require a minimum level of stiffness, to be removed easily from the liner. This is typically a continuous operation running at high speeds (30-1,000 labels per minute) in which articles to be labelled are presented continuously to the dispensing point where they are labelled.
v. The liner, coated with a release system, becomes a waste stream. This waste stream is collected on a rewind stand following dispensing and may subsequently be land-filled or sold into low value reprocessing.

The above process has existed for more than 50 years, and whilst it has undergone continuous improvement throughout this time with, for example, the use of thinner face and liner materials and the use of lower coat weights for the adhesive and release system, the basic construction has remained unchanged. During this time frame, the industry has developed enormous scale with the adhesive often coated on a wide web (up to 2-3 meters in width) of release coated liner at very high speeds, often well in excess of 1,000 meters per minute. The adhesive, coated on the release coated liner, is laminated to the face (film or

paper) web in the same process, forming the label stock which is supplied to printer/converters . Most label materials are manufactured this way through what is commonly known as a transfer coating process, so called because the adhesive is transferred to the face material from the release liner.

The adhesive can also be directly coated on the face material, followed by laminating with the release coated liner, commonly known as a direct coating process. That said, for many years, the industry has sought to find ways to effect labelling of pressure sensitive materials without using a liner and associated release system, thus significantly improving material and supply chain efficiencies, reducing cost, and eliminating an increasingly problematic waste stream. The so called 'linerless' solution has proved to be very elusive. Typically, approaches to linerless solutions have fallen into one of two broad categories, "Liner-free Labels" and "Activatable Labels".

Liner-free labels, while eliminating the liner, retain a silicone release system, and thus do not fully deliver the potential cost reduction. A liner-free system typically begins with printing of the face stock and then applying a release system to the printed face before coating the reverse side with a pressure sensitive adhesive to create a self-wound label stock that does not include a liner. Typically a self-wound stock is produced on narrow web presses using an expensive adhesive, often a UV-cured hot melt, at a speed considerably lower (well below 1,000 meters per minute) than that used in conventional adhesive coating described above. The cost accumulation of lower scale, higher cost adhesive, and the continued use of a release system mean that much, and sometimes all, of the cost benefit relative to the traditional process of eliminating the liner, is lost. The application of a silicone release coating to the printed face, either directly or by over-lamination of a clear filmic release liner, limits decorative options, for example tactile screen print.

Since the label printer is required to make additional investments to apply the release system and coat the adhesive, alternative processes have been developed whereby a clear release liner supplied as part of a conventional label stock is transferred from the adhesive side of the face stock and then laminated over the printed face in either a modified narrow web press or a separate finishing machine, before die cutting or slitting the web to produce individual reels of labels. Depending on the logistics, this process may provide a lower cost solution for the printer. However, it only delivers minimal overall savings based on use of thinner face materials and also restricts decorative options.

A further challenge facing such a liner-free approach is to create individual labels from the label stock (hereinafter referred to either as 'singulation or separation') at the point of dispensing by the end user. Since there is no liner to carry the pre-die-cut labels to the dispensing point, singulation can only occur at the point of dispensing. One approach to this challenge is offered by ETI Converting Equipment ("ETI"). After creating the self-wound

printed reel of labels, ETI deals with the singulation issue by using a temporary re-usable liner at the dispensing point. This allows a label to be die cut from the web, separated, and subsequently carried to the dispensing head by the temporary re-usable liner. Again, this reduces the cost benefit of the solution since a liner is re-introduced, and adds complexity, transferring to the end user the task of die-cutting perfect repeatably shaped labels, currently the responsibility of the label printer/converter.

Another approach to solving the dispensing problem of a liner-free adhesive system has been described by Catchpoint (e.g WO2009030893A1, to Cooper, et al.) in which labels are 'weakened' within the web prior to dispensing. In this scheme, the surrounds of labels within the web are both shaped and weakened by perforations by means of slits or holes. This 'weakening' is typically done on the printing press by traditional die-cutting, so that the weakened self-wound material can be provided to the end user in a state ready to use and still in conventional roll form. The line of weakening for each label includes apertures which provide for engagement by a tool at the time of dispensing in order to break the weakened area and thus separate the leading label in the web for subsequent application to an article. In this scheme, the self-wound web carries the label to the dispensing point where labels are removed from the web. Whilst such schemes solve the dispensing challenge, they have seen limited adoption because the limited cost benefit (as discussed above) of the total solution does not justify the additional investment in new final web control and separation tools in the label applicator. Catchpoint technology allows a degree of perfectly repeatable label shaping. On board linerless cutting systems such as that developed by, and branded as Monoweb®, add a responsibility that end users do not accept.

It should be noted that printable release systems do exist and therefore it is possible to reverse the order of release coating and printing but this does not in any way improve the cost of such systems. Commonly the use of printable release with a self-wound, liner-free, label stock is seen in areas which require simple printing. An example of this is shipping labels where printing occurs as labels are dispensed. This approach is not used for high quality labels which advertise a product, but typically for applications based upon direct thermal materials where cutting through the adhesive and the face stock may add downtime, although the cost of additional downtime may be offset by fewer reel changes due to elimination of a release liner. Printable release coatings do not accept thermal ribbon printing and require higher thermal printer temperatures to develop images, often reducing print head life.

Activatable Labels involve applying a specialty coating or cover layer to the adhesive system (essentially replacing the liner and the release system) or employing an adhesive system which is non-tacky at room temperature. In these solutions, a separate process, just prior to labelling, either removes the coating or cover layer to 'unmask' the adhesive, or activates the adhesive through an external stimulus such as heat or liquid. Activatable labels are supplied

to the end user in a non-tacky state, and activated, i.e., the adhesive is exposed or activated to a tacky state just prior to application to the intended article. Activatable labels are printed prior to activation. By far, the most common activation scheme utilizes heat activation.

Whilst activatable label schemes do indeed eliminate the liner and the release system, and, therefore eliminate a waste stream, they replace them with another, often more expensive material, add complexity, and do not meaningfully improve cost. The cost issues arise from the use of expensive components in a specialty coating which masks the adhesive, or from the use of expensive additives or process to create a non-tacky adhesive. The requirement for additional process assets to remove the coating or activate the adhesive adds further cost to the overall solution, and separating an individual label at the point of dispensing remains challenging without the use of a carrier web. As discussed, earlier approaches to separating each label at the dispensing point exist, but add cutting complexity and the cost of such activatable label solutions do not justify end-users engaging in this additional complexity.

It should be noted that due to the complex formulations needed to render an activatable adhesive non-tacky when wound in a reel, the adhesive after activation is commonly hazy in appearance which we define in this context as less than transparent. If the adhesive is hazy, a meaningful part of the label market, the so-called 'clear-on-clear' label, cannot be provided. In clear-on-clear systems, a label comprising a clear printed film and a clear adhesive is applied to an article and, due to the transparency of the clear printed film and clear adhesive, only the print is evident allowing a consumer to see product beneath the label. If the adhesive is hazy, then the appearance of the label becomes unacceptable.

Another linerless label material and apparatus for applying labels die-cut from the linerless label material has been described by Patel in WO2007/015264 wherein the pressure sensitive adhesive is protected with a pre-formed water-soluble film wherein the thickness of the pre-formed water-soluble film ranges from 5 microns to 40 microns, preferably from 10 microns to 30 microns, more preferably from 15 microns to 20 microns. This has failed to achieve commercial success as it proved impossible to remove sufficiently a pre-formed water-soluble film of said thickness, and thereby produce a sufficient level of adhesive tack within a commercially acceptable time interval.

Patel also described dissolving the water-soluble film from a printed linerless label material by passing through a trough containing water with a scrapping/recycling mechanism, die-cutting the labels, now with pressure sensitive adhesive exposed, and bringing them against a moving vacuum anvil (commonly a drum) which carries the labels to the dispensing head. This application system is similar to that first disclosed in the 1980's by Waddington plc and Freeman et al. The latter's Monoweb® brand application system processed a label web with sprocket hole registration control through to die cutting of a label with vacuum transfer to an article. These linerless application systems failed to achieve commercial success as end

users were unwilling to accept the technical risks of die cutting within a packaging line and the consequent matrix waste collection, neither of which limitations are addressed by Patel.

In a subsequent application, US2012061014, Patel describes the use of a water-soluble film of less than 5 microns, but none of the described coating methods provides a means to produce a water-soluble coating of said thickness. Shibano US4624839 teaches the use of starch derivatives in a release layer for self-wound adhesive tapes wherein, however, the release layer is not removed to expose the pressure sensitive adhesive as in the present invention.

Avery Dennison describes a bottle labelling invention in US2014065334/US9605183 in which a silicone release coating on a liner is replaced with a polyvinyl alcohol water-soluble "release agent" of thickness 0.1 to 5 microns on a liner in order that the liner may be recycled after removal from "an adhesive article". Paragraph [0027] states that "A release liner is coated with an amorphous PVOH polymer layer and applied to the PSA layer so that the amorphous PVOH layer is disposed between the PSA layer and the release liner". The liner is retained in providing "an adhesive article", the application process of which to a container is not described. No "adhesive article" as described by this invention has been commercialised which reflects a number of limitations which are addressed by the present invention, including a linerless label material, and a means of removal of a water-soluble coating within an acceptable time interval.

The present invention has been made from a consideration of the foregoing.

In one aspect the invention provides a method of applying a linerless label to an article as defined in claim 1. Optional features are the subject of claims 2 to 11.

In another aspect the invention provides an apparatus to at least partially remove a protective coating from a linerless label web to expose an adhesive and prepare the linerless label web for application of a label to an article by a linerless labelling machine as defined in claim 12. Optional features are the subject of claims 13 and 14.

The present invention described herein provides a truly linerless scheme, eliminating both a liner and a release layer, and replacing them with a low cost coating of a water-soluble polymer capable of removal within an acceptable time interval. It will be useful to provide an illustrative example of what may be considered to be an acceptable time interval. As noted above, labelling speeds are in the range of 30-1000 labels per minute. The larger the label, the slower will be the running speed of the labelling line, reflecting the longer filling times required for larger containers. If a typical label width in the Home and Personal Care sector is taken as 65mm, and a typical label application rate of 350 labels per minute, then this indicates a web consumption speed of 22.75 meters per minute. A commercially viable labelling system needs to provide at least partial removal of the water-soluble coating to reveal sufficient adhesive "grab" within a path length of 1.9 meters, which in turn would indicate that

the water soluble coating needs to be removed in less than 5 seconds. The present invention provides for sufficient removal of the water-soluble coating to enable the label to be fit for use within such a time interval. It thereby delivers on the cost-saving and environmental promise of a linerless solution which eliminates disposal of the liner and its release system which is often impossible to recycle and so must be incinerated or land-filled, both of which options are undesirable. Since the present invention can be practiced using proven, flexible, label application equipment, investment in providing a preparation module (claim 15 iv) according to this invention can be justified as the label material of this invention can be produced on wide web, high speed, capacity at lower cost. The narrow web label printer no longer has to coat a silicone release and can offer decorative brand features as required by his customer and a wider selection of variable information print options for logistic labels.

In order to exemplify the present invention, we will now describe the factors which, using warm water of any temperature between 15°C and 70°C, preferably 20°C to 40°C, may help to reduce the time interval required to at least partially remove a water-soluble coating within a time interval by which the present invention becomes commercially viable:

1. The speed of dissolution of water-soluble coating. Different water-soluble polymers have different dissolution characteristics. As the lack of commercial acceptance of the prior art described above has demonstrated, the use of a water-soluble coating in place of a siliconised liner has hitherto been frustrated by an inability to remove the water-soluble coating within an acceptable time interval, especially those water-soluble coatings based substantially upon polyvinyl alcohol polymers. As an example of faster dissolution, water-soluble coatings based substantially upon water-soluble polyurethane polymers such as those disclosed in WO1999/045050 have been found to dissolve more rapidly and to contribute greater cohesion between the adhesive system and the article than those based substantially upon polyvinyl alcohol polymers.

2. The extent, method and orientation of the washing procedure.

3. The extent of agitation provided at the surface of the water-soluble coating from first application of warm water to the water-soluble coating to application of the label to a container.

4. The concentration of water-soluble polymers in the washing means.

5. The interface and/or interaction between the pressure sensitive adhesive and the water-soluble coating. Due to the time taken to dissolve the water-soluble coating in its entirety, some part of the water-soluble coating may remain in place despite exposure to warm water. By use of the present invention, the presence of remaining water-soluble coating has been found to provide unexpected benefits due to the adhesive system created between the pressure sensitive adhesive and the solubilised

remaining water-soluble coating. For the avoidance of doubt, the adhesive system created between the pressure sensitive adhesive and the solubilised remaining water-soluble coating is created with all types of pressure sensitive adhesive including therefore water based, solvent based and hot melt formulations. The adhesive system so developed has been found to provide sufficient cohesion between the adhesive face of a label and a container to which the label is being affixed, to break the weakened boundary between the label and a following label when the article is moved with respect to the label web. The cohesion and peel strength between the label and the container is enhanced as curing of the bond takes place. Curing in this context is defined as the process during which the moisture content of any remaining water-soluble coating reduces to ambient levels.

In the light of the foregoing, it will be understood that the water-soluble coating should protect the adhesive sufficiently to provide a surface which, when dried, does not cause blocking of the adhesive when the label material is wound in a roll. The term blocking should be understood in this context to mean that the adhesive is insufficiently protected to prevent it from adhering to the face material when the label material is wound in a roll. Blocking indicates that the adhesive is under-protected.

However, it should be equally understood that the adhesive should not be over-protected by the water-soluble coating such that it cannot be sufficiently dissolved within a commercially acceptable time interval as has been described above.

The avoidance of both under-protection and over-protection is a key aspect of the present invention. However, any manufacturing process cannot be so constrained within narrow specifications that it becomes impossible to produce products that are reliably consistent in use and able to be offered at an acceptable price. Embodiments of the invention have therefore been developed to mitigate the necessity to impose narrow manufacturing specifications.

Under-protection may be mitigated by incorporating polymers which when dried provide a harder, less tacky, surface to the water-soluble coating. Over-protection may be mitigated by incorporating tackifying agents in order to enhance the initial “grab” of the label.

It will also be understood that the water-soluble coating may comprise formulations based not only upon water-soluble polymers but also upon water-soluble adhesives such as those containing dextrin, starch, gum Arabic, acacia gum, and/or gelatin although these examples of water-soluble adhesives should not be taken as limiting.

To exemplify our invention, the following describes one deployment of the novel linerless labelling process:

i. the process begins with the coating of adhesive to a first surface of face material (paper or film) presented as a roll as is done today with conventional label stock manufacture,

ii. either as part of the above process or in a subsequent process, a water-soluble coating comprising a substantially aqueous formulation of an appropriately selected water-soluble polymer or water-soluble adhesive, for example a polyurethane polymer, is then applied to the open surface of the adhesive. The water-soluble coating preferably has a thickness of less than 4 microns and more preferably between 1 and 3 microns. The water-soluble coating is then dried, for example by passing the coated material through a dryer in which a major part of the water is removed from the coating to a point where the pressure sensitive adhesive is fully protected and the coating is no longer tacky, such that the resulting label stock is then able to be wound in a roll without fear of the adhesive blocking. The roll can then be shipped to a printer/convertor. The water-soluble coating replaces the release system and liner of the prior art. It should be noted that a small percentage of the water may remain within the water-soluble coating after drying in order to contribute to plasticisation of the coating.

iii. the roll is unwound at a printer and the face stock printed, for example advertising information and/or brand related graphics may be printed with a full pallet of existing materials, or the graphics laminated to the face stock, to provide a decorative label

iv. during the printing process, but after printing or over-laminating , the face may be locally weakened, for example, die cut, or perforated by means of slits or holes, using for example a rotating die, to create a roll of printed material with individual labels defined by weakened areas at the extremities of each label, thereby weakening the force subsequently required to separate a label from the immediately following label.

v. the roll of printed and partially die-cut material may then be reeled to provide a single lane of labels for subsequent application.

vi. In the end users packaging line, these alternate format reels are fed into a separate preparation module which can be positioned adjacent to a proven linerless labelling machine. At the exit of the module, the linerless label web with open adhesive is delivered into these proven application systems. Within the preparation module, the web is controlled through a support assembly with the water-soluble coating exposed and the printed face held to the support by means which ensure that the water-soluble coating is exposed to warm water varying in volume and application intensity depending upon the speed of the linerless label web, causing the water-soluble coating to at least partially dissolve, thereby exposing at least partially the pressure sensitive adhesive. By this means, the face is exposed to the warm water and agitated washing. In an embodiment, exposure to a warm water spray or a washing procedure provided for example by rotating sponges, is divided into two sequential operations. In the first operation, the warm water spray or wash is provided by means of a circulating flow of warm water which may contain

dissolved water-soluble coating from previous washing of the linerless label web. In a second sequential operation, the flow of warm water is fresh feed without any dissolved water-soluble coating thereby providing a rinsing means. A part of the warm water from the second operation is subsequently used to replace that volume of water purged to drain from the first operation in order to reduce the concentration of dissolved water-soluble polymer and/or water-soluble adhesive.

vii. The web, now with a blend of open adhesive and residual water-soluble coating or water-soluble adhesive, is fed off the support assembly through a drying process where warm air removes residual free water such that the surface of the web only remains moistened, thereby retaining the cohesion required for label application, and then through a controlled loop fed by a turn bar if required from which the web is fed into a proven linerless applicator.

viii. at the dispensing point, the labels are separated by either breaking the lines of weakness, which were created during the printing process, and are then continuously applied by Catchpoint® teachings.

This linerless application system moves printed webs to the dispensing point from the new module where the water soluble coating is removed and the web dried using for example low surface energy belts in contact with the adhesive side of the web, and plasma coated drive rollers, friction belts, or vacuum belts in contact with the non-adhesive side of the web.

With a simple “wheel in” module to an existing labelling line, this solution offers a number of advantages over traditional pressure sensitive labelling. First, and most importantly it eliminates the need for a liner and release system. This has significant cost and environmental benefits. The liner itself formed from paper or film is expensive and represents 25% to 40% of the existing label stock. The release coating of silicone adds to this cost and ensures that any recycling of the liner material after label application becomes more complex.

The present invention therefore provides an apparatus to at least partially remove a water-soluble protective coating from a linerless label web to expose an adhesive and prepare the linerless label for application of a label to an article by a linerless labelling machine, the apparatus consisting of a series of assemblies including:

i) A driven unwind in which the linerless reel is vertically mounted and unwinds the reel to expose the water-soluble coated face of the label web.

ii) A preparation assembly comprising a splice table whereupon the end of a previous reel and the start of a new reel may be clamped and the webs joined by adhesive tape applied only to the printed face of the label web thereby retaining full exposure of the protective coating.

iii) A loop web tension and speed control feedback assembly which controls the outrigged power unwind to run and stop, balancing the throughput required by the linerless labelling machine.

iv) A coating removal means in which warm water is applied to the protective coating by washing and/or wiping and/or rubbing means, thereby at least partially removing the exposed protective coating wherein the web travels a required distance during a pre-determined time interval with such water flow, water temperature, and level of agitation as may be necessary to at least partially remove the water-soluble coating and sufficiently expose the pressure sensitive adhesive for adequate cohesion to the article.

v) A collection means to collect the wash water containing removed water-soluble coating, replacing a part of the wash water with fresh water when required.

vi) A release coated path pulley exposing both faces of the label web to a drying means thereby removing any excess water remaining upon the face material and the pressure-sensitive adhesive.

vii) An assembly providing variable heated air flow removes excess water from the web at temperatures which compromise neither the printed side nor the adhesive side of the label web, such that sufficient moisture remains on the adhesive side to provide the required level of cohesion between the exposed pressure sensitive adhesive and any residual water-soluble coating or adhesive and the article, to break the weakened boundary between the label and a following label when the article is moved with respect to the label web .

viii) An exit assembly including drives to draw the linerless label web through the preparation processes and through a second control loop which balances delivery of the label web to the stop/start profile of the linerless labelling machine, and turn bars to orientate the label web.

The present invention, as compared to other linerless labelling methods, has the added advantage of using the existing supply chain with proven materials and adhesive expertise. Current silicone based linerless systems impose added responsibilities to the label printer and, as previously stated, add to costs due to the narrow web slower speed processes. The printer, freed from the use of silicone release, whether by in-house coating or by using a clear relase liner transfer, is also able to match all current decorative requirements to maintain his relations with the brands and end users. With elimination of liner and cross web matrix from current die cutting the printers own waste levels are reduced. The lower cost of the new label stock reduces his set up costs and lowers his working capital requirements. The end user can now justify an investment in proven linerless label application systems as label costs are reduced, and the graphic pallet for decoration is not compromised. Another approach to high speed labelling, but not using a pressure sensitive adhesive, is a system called “Cut and

Stack". This labelling system is primarily for paper labels and involves the following typical steps:

i. paper face stock is printed with labels typically on a roll-to-roll press.
ii. the labels are die cut from the printed face stock and stacked in a magazine. It should be noted that the shapes of labels are typically confined to square or rectangular shapes. Typically this die cutting and stacking occurs at the end of the printing press.
iii. the stacked labels are delivered to an end-user who loads the magazine of labels into a feed system from which individual labels are taken and a water based glue. Is applied to the unprinted surface.
iv. the glue wiped labels are then transported to a dispensing point within the body of the labelling machine where they are applied to articles.

The cut and stack process is commonly used in high volume applications and provides an inexpensive form of paper labelling. However the system is only useful for paper labels because for filmic labels the quality is too low, especially in those cases seeking a clear label appearance, i.e. the so-called clear-on-clear applications, and it is difficult to effectively dry the water based adhesive with a filmic face. Cleaning these systems imposes significant downtime of the labelling apparatus and has never successfully met the demand for clear filmic label application. The present invention offers a cost-effective alternative to cut and stack by use of a separate preparation module which can be cleaned whilst a second module feeds the application process and since the open adhesive can be a pressure sensitive clear on clear construction, enables the use of filmic face. Current pressure sensitive labels have secured a growing share of this traditional market, particularly for beer bottle labelling where the higher label and liner disposal costs are readily justified by increase uptime, often in excess of 10%. For end users familiar with wet glue application and all the associated cleaning the removal of the water soluble film in the preparation module will simplify operations.

In summary, the present invention provides a linerless labelling method which eliminates both the liner and the release means and provides an apparatus which is able to process linerless labels converted from a label stock according to the present invention produced by an apparatus according to the present invention, thereby addressing the limitations of the prior art teachings.

The present invention provides a linerless labelling system in which a water-soluble coating protecting a pressure sensitive adhesive is at least partially removed within a commercially acceptable time interval whilst maintaining sufficient cohesion between the adhesive face of

an at least partially applied label and a container to break the weakened boundary between the label and a following label when the article is moved with respect to the label web, thus enabling substantial cost and environmental benefits to be realised without the need for significant capital investment.

A further benefit of the present invention is that it allows the use of a thinner face material and a lower coat weight of pressure sensitive adhesive, both providing additional cost savings. Conventional die cutting requires face materials of greater thickness than those required by the present invention and adhesive coat weights greater than those required by the present invention in order to avoid strikethrough, i.e. damaging the liner and leading to web breaks.

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CLAIMS

1. A method of applying a linerless label to an article in a continuous process wherein no waste material is rewound and wherein adhesive provided within a web of joined labels from which both liner and its release layer have been eliminated, is protected by a water-soluble coating which is at least partially removed by exposure to water and then dried prior to application of a label and wherein in a previous operation the web of label material is die-cut to include a weakened boundary between adjacent labels such that the cohesion established by the adhesive between an at least partially applied label and the article is sufficient to break the weakened boundary when the article is moved with respect to the label web.

2. A method according to claim 1 wherein the protective coating comprises substantially a water-soluble polymer.

3. A method according to claim 1 wherein the protective coating comprises substantially a water-activated adhesive.

4. A method according to claim 1 wherein a web of pre-weakened labels is singulated and attached to an article without the use of a release agent or an intermediate liner.

5. A method according to claim1 wherein the protective coating has a thickness of less than 4 microns.

6. A method according to claim 1 wherein the adhesive is pressure sensitive.

7. A method according to claim 1 wherein the adhesive and residual protective coating, the latter having been solubilised by exposure to water, provide an adhesive system which after curing, offers greater cohesion and greater peel strength than that offered by the adhesive without any protective coating.

8. A method according to claim 1 wherein the time interval during which the label web is exposed to water is less than 10 seconds.

9. A method according to claim 1 wherein the time interval during which the label web is exposed to water is less than 5 seconds.

10. A method according to claim 1 wherein the temperature of the water is at least 20°C

11. A method according to claim 1 wherein the temperature of the water is at least 40°C.

12. An apparatus to at least partially remove a water-soluble protective coating from a linerless label web to expose an adhesive and prepare the linerless label for application of a label to an article by a linerless labelling machine, the apparatus consisting of a series of assemblies including:

    i) A driven unwind in which the linerless reel is vertically mounted and unwinds the reel to expose the water-soluble coated face of the label web.

    ii) A preparation assembly comprising a splice table whereupon the end of a previous reel and the start of a new reel may be clamped and the webs joined by adhesive tape applied only to the printed face of the label web thereby retaining full exposure of the protective coating.

    iii) A loop web tension and speed control feedback assembly which controls the outrigged power unwind to run and stop, balancing the throughput required by the linerless labelling machine.

    iv) A coating removal means in which warm water is applied to the protective coating by washing and/or wiping and/or rubbing means, thereby at least partially removing the exposed protective coating wherein the web travels a required distance during a pre-determined time interval with such water flow, water temperature, and level of agitation as may be necessary to at least partially remove the water-soluble coating and sufficiently expose the pressure sensitive adhesive for adequate cohesion to the article.

    v) A collection means to collect the wash water containing removed water-soluble coating, replacing a part of the wash water with fresh water when required.

    vi) A release coated path pulley exposing both faces of the label web to a drying means thereby removing any excess water remaining upon the face material and the pressure-sensitive adhesive.

    vii) An assembly providing variable heated air flow removes excess water from the web at temperatures which compromise neither the printed side nor the adhesive side of the label web, such that sufficient moisture remains on the adhesive side to provide the required level of cohesion between the exposed pressure sensitive adhesive and any residual water-soluble coating or adhesive and the article, to break the weakened boundary between the label and a following label when the article is moved with respect to the label web .

    viii) An exit assembly including drives to draw the linerless label web through the preparation processes and through a second control loop which balances delivery

of the label web to the stop/start profile of the linerless labelling machine, and turn bars to orientate the label web.

13. The apparatus according to claim 12 in which the temperature of the water used for removing at least partially the protective coating is between 5° to 60° C, preferably 15° C to 50° C more preferably 20° C to 40° C.

14. The apparatus according to claim 12, wherein the said article with affixed label is dried in a dryer or series of dryers at temperature ranging from 15°C to 125°C, preferably from 30°C to 90°C, more preferably from 45°C to 75°C.