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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No.

EV436509269US

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☐ Additional inventors are being named on the _____ separately numbered sheets attached hereto					
TITLE OF THE INVENTION (500 characters max)					
TECHNIQUES FOR LABELING PLASTIC, GLASS OR METAL CONTAINERS OR SURFACES WITH PRE-ADHESIVE COATED PAPER LABELS EMPLOYING AN ACTIVATED HYDROPHILIC LAYER					
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ENCLOSED APPLICATION PARTS (check all that apply)					
☒ Specification Number of Pages		29		☐ CD(s), Number	
☐ Drawing(s) Number of Sheets				☐ Other (specify)	
☐ Application Data Sheet. See 37 CFR 1.76					
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT					
☐ Applicant claims small entity status. See 37 CFR 1.27.				FILING FEE AMOUNT (\$)	
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
☒ No.					
☐ Yes, the name of the U.S. Government agency and the Government contract number are:					

Respectfully submitted,

SIGNATURE

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Date 01/24/2005

REGISTRATION NO.

(if appropriate)

Docket Number:

25,669

181-048

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

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5 TECHNIQUES FOR LABELING PLASTIC, GLASS OR METAL
CONTAINERS OR SURFACES WITH PRE-ADHESIVE COATED PAPER
LABELS EMPLOYING AN ACTIVATED HYDROPHILIC LAYER

FIELD OF THE INVENTION

10 This invention relates to pre-coated paper sheets or
rolls particularly adapted for use as labels in the post
mold labeling of plastic, glass or metal containers or
surfaces. More particularly, the present invention
relates to paper substrates adapted for printing that
15 also have a pre-coated hydrophilic surface layer
activatable into an adhesive layer for use as labels in
post mold labeling applications using conventional wet
applied water based labeling equipment typically used for
the application of paper labels where the adhesive layer
20 is applied on the labeler utilizing a wet (aqueous) glue
layer. In another aspect the invention relates to such
labels which possess the pre-applied activatable adhesive
layer which are able to be applied on conventional post
mold paper labeling equipment using wet applied water
25 based solutions comprising water or water blended with a
selected cross-linking agent.

BACKGROUND OF THE INVENTION

30 Plastic and glass containers or bottles are prevalent in
a wide variety of shapes and sizes for holding many
different types of materials such as detergents,
chemicals, motor oil, beer, etc. These containers are
glass or plastic (mono or multi layers) of polyethylene,
35 polypropylene, polyester or vinyl along with other
specialty blends for specific barrier and product
resistance performance. Generally such containers are
provided with a label which designates the trade name of
the product and may contain other information as well.
40 The early art which still is prevalent today employed the
use of labels manufactured from paper substrates that
were applied with a water based adhesive where the water

5 based adhesive is applied to the paper substrate on the labeling machine.

One of the oldest and still prevalent labeling techniques is the application of paper based labels to glass and plastic containers using natural and synthetic labeling adhesives such as BL300 produced by Henkel Adhesives or OC363-20 produced by O.C. Adhesives Corp. which are known in the art. This is a safe (water based) proven technology that has grown and been employed for many years and consequently there are many existing machines that have been installed for this type of labeling technique such as from Krones, Neutraubling, Germany that run cut precut labels or Koyo, Japan which runs roll stock that is cut on machine to the label size. The wet labeling adhesives are typically high viscosity mixtures that are difficult to handle, machine and consistently meter in a uniform and consistent manner. Typical adhesive application on the labeler can vary from 1 - 4 wet mils of adhesive at a typical 50% solids which is a range of 8 - 32 pounds of adhesive for a 3000 square foot ream of paper. Additionally, many of these machines run constantly 24 hours a day and the maintenance and clean up of the adhesive applicator causes a lot of down time on the line and cost in labor and lost production.

30

The cut label techniques and associated adhesives work well with paper based substrates applied to glass, plastic or metal containers because the wet adhesive wicks (absorbs) into the paper substrate from the applicator roll, pad or pallet which breathes and allows the moisture from the water carrier to be absorbed by and dry thru the paper base.

40 Typically, wet applied cut label machines work where

5 glued pallets rotate and come in contact with a glue
applicator roll and become wetted with adhesive. The
adhesive wetted pallet then is pressed in contact with
the back side of the paper label where the adhesive
penetrates the paper fiber with enough initial tack to
10 remove the label out of the label holding magazine while
simultaneously gluing the back side of the label. This is
accomplished by applying a thin glue film to the pallet
of 1 to 4 wet mils of adhesive picked up from the
applicator roll metering system in a pattern or with 100%
15 coverage which is then pressed in intimate contact
against the first label in the stack. The glue roller and
pallet systems in the current art typically employ a
steel glue roller and a hard rubber pallet with a
durometer greater than 60 or a rubber glue roller and an
20 aluminum or coated steel pallet. Either combination
provides for a firm pallet to transfer the adhesive.

After its removal, the label sticks on the entire glued
area of the pallet until transferred to a "gripper"
25 cylinder and is removed from the pallet typically using a
mechanical finger or vacuum mechanism. The gripper
cylinder then transfers the label to the container to be
labeled. The various machine designs and techniques are
well known within the labeling industry and to those
30 skilled in the art. The "Krones Manual Of Labeling
Technology" by Hermann Kronseder dated December 1978, is
hereby incorporated by reference.

In recent years, as described in U.S. 6,663,746 and
6,517,664, which are incorporated by reference, polymeric
35 film labels using a hydrophilic glue receptive layer and
a water based adhesive composition are now being used.
The applications also describe the concept of rewetting
the hydrophilic layer with an aqueous medium (water that
may contain a cross-linking agent) to activate the
40 hydrophilic layer into an adhesive layer. It has
surprisingly been found that this concept, having a pre-
applied adhesive layer that is activatable into an

5 adhesive on the labeler using water, a water based
solution or water with a crosslinking agent provides a
unique cost saving approach to labeling on cut and stack
label machines when the pre-applied activateable coating
is applied to a paper label substrate.

10 Accordingly, it is an object of the invention to provide
a pre-coated paper label particularly adapted for use in
post mold wet applied labeling of polymeric, glass and
metal containers that has a dry non pressure sensitive
hydrophilic layer uniformly pre-applied that can be
15 activated into an adhesive layer. This is accomplished by
pre-applying by coating, the layer that is activated on
the labeling machine with an aqueous medium that is not
an adhesive to become tacky and function as an adhesive
to affix the label to the container. The activated label
20 will readily feed from the label magazine or gripper,
adhere with sufficient tack without moving through post
labeling handling and processing including but not
limited to conveying, filling, case packing and
palletizing.

25 It is a primary object of the invention to provide a
paper label with a pre-applied hydrophilic layer
consisting of at least 30% dry by weight of animal glue
that can be activated into an adhesive layer through an
30 aqueous medium on the labeler particularly adapted for
use in post mold labeling of polymeric and glass
containers that would have sufficient wet tack and
affinity for water or a water based solution to allow for
transfer of the water or solution to the paper label
35 substrate from the applicator roll(s), pad(s) or
pallet(s) of the labeling machine to activate it into an
adhesive. The combination of the pre-coated activatable
hydrophilic layer and activating solution combine to form
the adhesive to adhere the label to the surface to be
40 labeled.

SUMMARY OF THE INVENTION

In considering the performance or economic shortcomings of prior art materials, I have discovered an improvement to the process of labeling paper labels on an automatic labeler by which a paper label with a uniform pre-applied hydrophilic layer comprising at least 30% by dry weight of an animal glue can be applied to a container by activating the hydrophilic layer to form a tacky adhesive when wet on the labeler by an aqueous medium before being applied to a glass, plastic or metal container or surface. The process may be carried out in a more consistent and uniform manner than a labeling process that uses a non activatable layer that requires a heavy adhesive layer applied on the label machine to function. The method of the invention comprises:

(a) applying a uniform layer of a hydrophilic solid material containing at least 30% by dry weight of animal glue to a paper label substrate based on the combined weight of the hydrophilic solid material and the weight of the animal glue and any additive, e.g. cross-linker, and optionally drying said hydrophilic solid material to form an activatable hydrophilic layer on said paper label that can be activated into a tacky adhesive;

(b) applying on a labeler a light deposition of water or water containing a cross-linking agent over said activatable hydrophilic layer to form a tacky fastenable paper label free of bubbles and uneven adhesive streaks typical of the standard deposition of adhesives applied on aqueous labelers;

(c) fastening said fastenable paper label to a glass, plastic or metal container or surface; and

40

- 5 (d) curing said paper label on said glass, plastic or metal surface or container.

Containers labeled according to the process of the invention, where a cross-linker is present in the dried
10 adhesive composition which is made up of the activatable hydrophilic layer and activating solution are novel articles as they have a label that has not been previously described.

It has been found that cellulose based substrates with a
15 porous structure like paper that are judiciously applied with an activateable hydrophilic layer show superior adhesion when rewet and pressed onto the glass metal or plastic container because the open area of the paper fibers provides enhanced surface area for penetration and
20 enhanced adhesion.

DETAILED DESCRIPTION OF THE INVENTION

Pre-applied activatable hydrophilic materials containing
25 animal glue that can function as an adhesive are formulated so that the activatable adhesive coating will have hydrophilicity, absorbtivity, wet tack and drying properties that will permit the paper label to be applied to polymeric, glass or metal containers via water based
30 wet labeling techniques on standard paper labeling equipment using a water based solution or a water based solution plus a crosslinker but not an adhesive as conventionally used on paper labelers in the current art. It is contemplated that the pre-applied hydrophilic
35 material will be dried on the paper substrate and rewetted at the time that the labeling material is applied to a container. The apparatus which is used to apply paper labels is well known to those in the art. The paper label substrate with the activatable hydrophilic

5 layer will demonstrate sufficient "wet tack" during the
label application period and the label drying period to
permit containers to be handled and processed.

As used herein the reference to a "container" includes a
10 surface of an object made of glass, plastic or metals
such as bottles, cans, toys and building materials.

The activatable hydrophilic component or blends
containing animal glue will be applied in the present
15 invention to the selected paper sheet in a continuous or
patterned layer to provide the absorptive, wet tack,
adhesive and drying properties that are necessary to
enable paper sheets to be successfully used as label
substrates on polymeric or glass containers when
20 activated through wetting with water or water and a
cross-linker where the labeling apparatus is configured
to apply the minimum amount of aqueous solution to
activate the layer into a tacky adhesive when wet, but
not excess aqueous medium to saturate the activatable
25 layer causing it to loose its adhesive properties and not
adhere well and take a long time to dry. The activatable
hydrophilic layer which is applied through the sizing or
coating process on a paper making machine, by coating on
a coating machine off-line from the paper manufacturing
30 step or in-line with printing on a printing press has the
function of absorbing moisture to activate the layer as
an adhesive when wet with an aqueous medium thus causing
selected hydrophilic layers to function as an adhesive
without any applied adhesive as is conventionally
35 performed on aqueous labeling machines in the art. It is
important and key to this invention to minimize the
amount of aqueous medium used to activate the hydrophilic
layer as an adhesive. Excess activation moisture
decreases the tack of the activated layer as it becomes
40 saturated with moisture and will lead to longer drying
times and loss of adhesion properties. Additionally, the
ability to minimize machine applied imperfections such as
bubbles and streaks typical in the current art when

5 heavy adhesive layers are applied on the labeling machine
is dictated by the amount of activating medium used and
if excess is used, it detracts from the concept of a pre-
applied defect free adhesively activated hydrophilic
layer.

10

As previously mentioned, typical adhesive application on
a paper labeling machine using adhesive is from 4 -
16lbs. /ream dry application. Using the pre-applied
technique of this invention, the activatable layer can be
15 coated at 2 - 8lbs./ream, preferably 2 - 4lbs./ream and
activated with minimal moisture to effectively eliminate
in most applications up to >50% or more of the adhesive
layer resulting in an approximately > 50% or more
savings in adhesive cost as a tangible savings. Applying
20 a light deposition of water or water based solution will
allow for increased label line up time and efficiency and
less maintenance and clean-up cost of the glue applicator
and associated equipment from the high viscosity glues
commonly used all leading to intangible savings that will
25 be difficult to put a hard cost on but will be
significant.

The term "paper facestock" or "paper label substrate" as
used herein should be taken for purposes of the present
30 invention to refer to a paper material that can be
uncoated, coated or sized on one or two sides so that it
is rendered printable by conventional printing techniques
such as gravure, flexographic, lithographic, screen or
other digital techniques such as ink jet, laser and
35 thermal transfer.

The "activatable hydrophilic layer" previously mentioned
has the properties after application to the paper but
before activation of minimal tack when dry so labels can
40 be unwound from a roll or separated from a stack and once
activated with moisture, it will have the properties of
wet tack, absorbtivity, drying, sufficient adhesion to
the paper label substrate and affinity and adhesion to

5 the container to be labeled in the wet or dry form.

An activatable hydrophilic layer is defined as containing at least 30% by dry weight of animal glue that can be wet or remoistened with a water based solution for use on a
10 glass, plastic or metal container.

As used herein and in the appended claims, the term "hydrophilic" is used to describe materials or mixtures of materials which bind, pass or absorb water. The term
15 ``activatable hydrophilic layer'' describes a hydrophilic layer that when binding, passing or absorbing water becomes activated and transforms into an adhesive layer with wet tack and affinity for the container to be labeled. The term activated as used herein describes the
20 change in a dry pre-applied dry hydrophilic layer on a label substrate to a wet adhesive layer when activated with an aqueous medium that will adhere to the container wall to be labeled, dry and set up with strong adhesion.

25 The preferred "activatable hydrophilic" materials of the present invention are based on animal glue coating which in broad terms is an organic colloid of protein derivation from collagen which is a protein constituent of hide materials and bones obtained using well know
30 techniques widely used to provide many commercially available glues. Hide animal glue is preferred over bone animal glue because of superior physical properties and strength. The animal source is not critical and glues may be derived from wild or domesticated animals such as
35 horses, cattle, pigs, sheep and the like. Purified versions of animal glue are also known as gelatin. Animal glues are commonly graded on comparative gel gram strength values by manufacturers and provides a rough guide for use but this standard does not always measure
40 their working qualities as adhesives for glass, plastic and metal containers. Considerations of gram strength, pH, ash content, clarity, grease content, type of glue (bone or hide), degree of purification and processing

5 methods all have a bearing. The gram strength measurement
of animal glue is also known as a gel strength
measurement which ranges from about 30 grams (weak) to
500 grams (exceptionally strong) where the highest gram
strengths contain greater amounts of reactive glue
10 protein. Typically, stronger adhesive bonds are achieved
with higher gram strength animal glues and blends of
animal glues. Unfortunately, as gram strength increases,
so does the dry brittleness of the glue which must be
addressed in formulating using modifying components such
15 as plasticizers, humectants and modifying synthetic resin
dispersions.

In physical form, dry animal glues are odorless,
relatively tack free hard materials ranging in clarity
20 from light amber to dark brown depending on the origin,
processing technique and degree of purification that
contain 10 - 14% moisture. Almost all grades can be made
up into aqueous solutions.

25 In water, solutions of animal glues based on hide which
are typically the higher gram strength variety preferred
for use in this invention instead of bone based glues are
generally reaction neutral and have a pH range of 6.4 -
7.4 which is a pH that makes them compatible with many
30 other materials. The specific gravity of dry animal glue
is approximately 1.27.

An important feature of animal glue in the present
invention is that when dry animal glue is placed in cold
35 water like an ice chest for beverages, animal glues do
not dissolve readily but swell absorbing considerable
water forming a gel state and must be heated to dissolve
into solution at 100 - 140 °F. The rapid development of
a gel state when wet with an aqueous medium provides a
40 fast set and tackiness with quick development of initial
bond and holding strength which is critical for the
successful application of paper labels to glass, plastic
and metal containers using wet labeling techniques. For

5 applications where long term contact with water and
subsequent swelling of the animal glue could cause a loss
of adhesion, it is preferred to crosslink the animal glue
to make it moisture resistant. One of the keys to this
invention is maintaining the beneficial properties of non
10 cross-linked animal glue for label application using at
least 30% animal glue in the activatable hydrophilic
layer which is then cross-linked and rendered moisture
resistant after application by the water containing a
cross-linker which is applied when the hydrophilic layer
15 is activated into an adhesive. High speed labelers run
from 200 - 1,200 container per minute and the cross-
linking reaction is relatively slow even at high levels
of cross-linker so the layer can be wet, develop tack and
adhesion to the container to be labeled and cure to
20 moisture resistant over time. This time period varies
depending on the activatable layer formulation, cross-
linker of choice and amount of each component used along
with the amount of water that must be absorbed and dried.
The time period can run from 12 hours to 14 days but
25 stable formulations that are rendered moisture resistant
in 72 hours are adequate for most commercial labeling
applications. A key advantage of cross-linked activated
adhesives consisting predominantly of animal glue is that
when dry and rendered moisture resistant, the adhesive is
30 not impervious and hard and in fact the adhesive layer
will ``give'' or move slightly under high moisture
conditions and contact the surface to be labeled on
drying providing a ``live'' adhesive bond that takes up
the stresses and strains that normally occur under
35 labeling and drying conditions.

Another key benefit of an adhesive layer containing
animal glue that forms a gel structure is that if the
surface to be labeled is cool, the animal glue component
40 will gel faster and set a bond faster because it is less
fluid. This can be an important factor in brewery
applications where post mold labeling of cold beer or

5 cold storage of labeled containers can accelerate the
bond of the activatable layer.

Another important feature of animal glue layers,
particularly those deposited from water or wet with water
10 is that when dry, they exhibit high adhesive strength,
are continuous, non-crystallizing, non-cracking and of
great strength and elasticity. Additionally, animal glue
is reaction neutral, relatively odorless, non toxic and
non corrosive. Due to its unique protein structure,
15 animal glue is not precipitated by acids or alkali's and
is resistant to structural breakdown by acids or alkali's
within normal practical limits so for use as a labeling
adhesive where the contents of a container could leak or
drip down the side of the container and attack the
20 adhesive, animal glue is durable. Animal glue based
adhesives are also resistant to grease, oil, alcohol and
other chemicals that are free of water and as stated
above, to overcome moisture sensitivity, animal glue can
be rendered moisture resistant by cross-linking.

25

For glass containers, it is preferred to use high gram
strength animal glues at a level of at least 50% dry by
weight of the activatable hydrophilic layer to achieve a
30 strong bond where the gram strength of the animal glue is
greater than 50 grams and more preferably in the range of
175 - 225 grams. More preferably, for glass containers a
dry level of animal glue between 50-80% is preferred
as is a gram strength in excess of 175 - 250 grams (also
35 known as gel strength). The higher the gel strength of
the animal glue, the stronger the adhesive bond to glass
will typically be but also the more brittle the bond will
become, especially after crosslinking so the 175 - 250
gram range while not limiting, is preferred for many
40 applications. Animal glue shows a specific affinity for
glass and coated glass and is ideal as a base component
to be formulated into an activatable hydrophilic adhesive
layer because of its strong wet tack and affinity for

5 glass. Animal glue has such a strong affinity for glass
that some formulations when dry and adhered to the glass
will pull glass particles with it when removed. This has
been proven by those that use animal glue to create
chipped glass or frosted glass decorative designs using
10 animal glue allowed to dry on glass that is subsequently
removed. This high affinity and bond strength to glass is
why animal glue is the key component of this invention
for activatable layers on paper labels for high speed
post mold labeling.

15 For plastic containers, it is recommended to use or blend
synthetic acrylic polymers which bind or absorb water and
become adhesives such as polyacrylic acid, polyacrylic
acid copolymer or carboxylated sodium polyacrylate with
20 the animal glue to promote adhesion to the plastic
container wall. For plastic containers, the dry animal
glue level in the activatable layer can range from 30 -
80% but it is preferred at a level of 35 - 45% in
combination with synthetic polymers. Moisture sensitive
25 synthetic polymers that can be rendered insoluble through
cross-linking can be added at levels up to 70% dry
polymer

Amounts of non moisture sensitive synthetic polymers can
30 also be added as modifiers at levels up to 50% dry
polymer but most preferably at levels up to 25% dry
polymer.

If synthetic polymers are used, they can be in the form
of solutions, dispersions and emulsions but solution
35 polymers are preferred.

In addition to synthetic resins as discussed above,
animal glue solutions are compatible with select natural
resins, modifying additives such as plasticizers, oils,
40 fats, waxes along with other adhesive materials such as
casein, starch, dextrine and gums under certain
conditions.

5 To plasticize and increase the flexibility of animal glue
and control lay flat, modifiers such as urea,
polyethylene glycol, glycerin, sorbitol, cane or invert
sugars or combinations of the preceding are added at
10 levels up to 40% dry and most preferably 25-30% dry
depending on the properties desired but preferably at
levels <30% if the activatable layer is subsequently to
be reacted (cross-linked) to be rendered resistant to
moisture to minimize the level of non-reactive components
in the matrix of the activatable hydrophilic layer. It is
15 noted that urea acts as a gel dispersant to reduce the
viscosity of the gel for coating applications while it is
inert in the animal glue matrix.

A discussed above, a preferred aspect of the present
20 invention is to use cross-linkable (reactive) components
in the activating aqueous solution to react with the
hydrophilic layer that converts into an adhesive that
cures to become more moisture resistant as it dries and
builds adhesion to the container wall. Not only does the
25 cross-linking agent make the activated adhesive more
moisture resistant, it can provide greater initial wet
tack versus using water only and promotes adhesion to the
container wall while increasing chemical resistance to
materials that may come in contact with the adhesive
30 layer. Examples of synthetic cross-linkable materials are
those which contain carboxyl groups, hydroxyl groups or
other functional group which will react with a cross-
linking agent. When water and a cross-linking agent are
combined, the composition will comprise 0.005 - 10% by
35 wt. of cross-linking agent. Preferred crosslinking agents
are Polycup 172 from Hercules and Glyoxal available from
BASF Corporation.

The activatable hydrophilic layer converts to a wet tacky
40 adhesive layer when wet with an aqueous solution which is
defined as a substance capable of combining two surfaces
by the formation of a bond.

5

The use of the properly formulated activatable hydrophilic layer for a given paper labeling substrate and container to be labeled will have a direct effect on the speed which the labeling line can be run. When considering the choice of the activatable material which forms the hydrophilic layer, one must consider the paper label substrate, container to be labeled, labeling machinery, activation technique and down stream processing requirements such as filling, conveying and packing. Generally, a dry deposit of from 2 to 8 lbs./3000 square feet of the activatable hydrophilic layer, when dried, may be employed on the paper layer depending on the particular material that is selected. Preferably, 2 - 4 lbs. / 3000 square feet is preferred.

20

It is critical to the successful application and use of an activatable hydrophilic paper label to control how the water or water based adhesive is applied to the activatable hydrophilic layer, how deposition (weight or thickness) is controlled and how the resultant combination with the container is pressed together. Generally, from <0.05 to 1.0 g. /sq. ft. of activating medium (water or water plus crosslinker) is applied to the pre-applied activatable hydrophilic layer with 100% coverage of the label with a preferred range of 0.1-0.25 g. / sq. ft. If a grid or other pattern of activating medium is employed, then the amount of activating medium may be reduced. If a grid pattern is employed, the hydrophilic layer may be applied to be substantially in register with the activating medium.

35

It is critical to the successful application and use of an activatable hydrophilic paper label to precisely control how the amount of aqueous activating fluid medium (water or water plus a cross-linker) is applied so that an effective amount will be employed. Too much aqueous medium for a given deposition of activatable hydrophilic layer will overpower the layer and will result in loss of

40

5 tack and initial adhesion and will result in labels
`swimming: or moving as the labeled container is
conveyed, filled or packed and will increase the drying
time of the activated layer to produce a firm adhesive
bond to the wall of the labeled container. Not enough
10 aqueous activating medium will not completely develop the
full adhesive properties of the activatable layer and
will result in poor bonds.

For optimum aqueous medium application control, optical
15 appearance and uniformity, it has been found that it is
preferable to use smooth applicator pallets to apply the
activating solution which for purposes of this invention
includes water or water plus a crosslinking agent. The
activating solution is not limited to these components
20 but will include them as a major portion of the
activating solution with minor components such as
biocides, wetting agents, fragrances, humectants,
defoaming agents, viscosity modifiers and rheological
modifiers also contemplated.

25 In a preferred embodiment, conventional hard rubber,
metal or aluminum glue applicator pallets are modified by
adhering a compressible surface like a foam layer with a
smooth surface to the adhesive or activating side of the
30 pallet. This allows for intimate contact between the
applicator pallet and applicator metering roll when the
activating solution is applied to the compressible
surface and for intimate contact between the wetted
pallet and the hydrophilic layer when the wetted pallet
35 with activating solution is pressed in intimate contact
with the hydrophilic layer. Compression of the soft foam
like layer as it contacts the wetted applicator roll in
contact with the activating solution is important as a
means of uniformly controlling pick up of the activator
40 solution. As detailed earlier, it is critical to control
the deposition of the activating medium to a low level.
The compression of the foam modified pallet in
combination with the gap adjustment of the applicator

5 roll system allows for uniform metering and control of
the activating solution. An added benefit is that the
compression causes a wiping action as the compressible
surface of the applicator pallet rotates past the
applicator roll to pick up the activating solution
10 providing for a uniform application of solution where
uneven application or even foam is smoothed out and made
uniform.

When the wetted compressible pallet comes in contact with
15 the activatable hydrophilic layer to pull the label out
of the basket for application, the intimate contact of
the compression provides for uniform application and
wetting of the activatable hydrophilic layer to promote
best optical clarity and ultimate adhesion of the label
20 after drying.

The modified compressible surface must be smooth and
wetable which means the activating solution must wet out
on the surface. In a preferred embodiment, the foam will
25 compress at least 5% of its thickness for the optimum
wiping action and will have a durometer of < 50 . More
preferred are is compression of about 5-50% of the
thickness of the label and preferably $> 10\%$ and a
durometer of about 10-40 and preferably < 30 with a glass
30 smooth surface. The type of compressible foam like
substance is not limiting but durable compounds like
silicone and urethane polymers are preferred.

35 As with any adhesive labeling technique, the type of bond
achieved is a fine balance between the container surface
to be labeled, the label material, adhesive formulation
which in this case is the activatable hydrophilic layer
in combination with the aqueous activating fluid and the
40 deposition of the activated adhesive. For purposes of
this invention, the adhesive layer is the combination of

5 the activatable hydrophilic formulation and the
activating medium whether it is water or water and a
cross-linking agent. The ultimate adhesion properties are
controlled by the surface characteristics of the material
to be labeled and the choice of adhesive layer
10 formulation and deposition of the adhesive layer

The choice of the adhesive layer made up of the
activatable hydrophilic layer and activating medium, the
type of label substrate and container to be adhered
15 together, the plant processing conditions after labeling,
storage requirements and the end use requirements that
must be met such as high temperature resistance, ice
proofness or passing a 24 - 72 hour ice bath soak are
important considerations. There are many more specific
20 variables within these considerations all of which
influence the formulation of the proper activatable
hydrophilic layer and activating medium for a specific
application.

25 The bonding of the activatable layer can be accomplished
with mechanical (non smooth surfaces) and specific
adhesion. It has been found that the preferred animal
glue component of the activatable layer provides superior
adhesion characteristics when the layer is activated by
30 water or a water containing a crosslinking agent such as
zirconium salts of mineral acids, such as Bacote 20 from
Magnesium Elektron, Inc., water soluble polyamide-
epichlorohydrin material such as Polycup 172 from
Hercules, Glyoxal available from BASF Corporation or an
35 aldehyde donor such as Glutaraldehyde that rapidly cross-
links the animal glue and the like which may be used at a
level of 0.01-8% by weight of the activatable layer
composition.

40 Mechanical adhesion is defined as the bonding between
surfaces in which the adhesive holds the parts together
by inter-locking action and actual physical penetration.
Specific adhesion is the bonding between surfaces which

5 are held together by molecular forces wherein the
surfaces are non porous and no penetration is possible.
These forces are related to the polarity and size of the
molecules, pore size of non smooth surfaces and the
initial action in obtaining a bond when the activated
10 surface is wet, becomes tacky and a bond develops through
molecular forces.

The activatable hydrophilic layer and activating fluid
15 that combine into the adhesive must wet out the surface
of the container to be labeled. This is accomplished by
applying the activating medium to the selected
activatable hydrophilic layer which when applied to the
container to be labeled brings the hydrophilic layer
20 activated into an adhesive and container wall into
intimate molecular contact. By using an aqueous fluid
activating medium that wets and penetrates the
hydrophilic layer as well as the container surface, a
fluid region is created that flows to cover the surface
25 as completely as possible. This is critical to the
invention where even an apparently smooth surface in
reality is composed of a random network of hills and
valleys. When the activated hydrophilic layer is in the
wet condition, it serves as a wetting bridge to promote
30 adhesion. The more rapidly the activated hydrophilic
layer can be applied (pressed in intimate contact with
the surface to be labeled), the greater the fluid region
will be before the activating medium is absorbed into the
hydrophilic layer, the better the wetting at the adhesive
35 interface will be resulting in stronger ultimate bonds.

Optionally, if just water or water and a cross-linking
agent are used as the activating medium, it is preferred
40 to thicken the water or solution for better machining on
the labeler that is designed to handle higher viscosity
mediums such as conventional labeling adhesives. Many
commercially available thickeners can be used but special

5 mention is made of the Laponite family of synthetic
thickeners from Southern Clay Products that form a gel
structure of an aqueous solution at low addition levels
that will not overpower the adhesive properties of the
activated medium and will not interfere with the ultimate
10 bond or moisture sensitivity of the dry adhesive at the
low levels used to thicken the aqueous solution.

It is clear that one specific activatable hydrophilic
layer may not fit all applications but it has been found
15 that the activatable hydrophilic layers of the present
invention can be tailored to particular applications
based on the conditions and requirements for wet PML
labeling of paper substrates but the activatable layer
must contain at least 30% by weight of the dry
20 activatable layer of animal glue that when activated
(wet) by an activating fluid medium becomes sufficiently
tacky to adhere a paper label to a container through
filling, conveying, processing or packing that will
subsequently dry and provide good adhesion to the
25 container. When working with natural and synthetic
activatable layers that are obviously sensitive to
moisture, it is important depending on the moisture
sensitivity of the formulation to add a humectant to the
activatable layer at a level of 0.25-25% by dry weight to
30 provide curl resistance and to impart lay flat properties
to the paper labels. The humectants also tend to act as
plasticizing agents so the activatable layer does not
become too brittle when dry and include urea,
polyethylene glycols such as PEG400, polyvinyl alcohol,
35 glycerin, sorbitol and the like.

Slip aids and anti-blocking compounds commonly used in
the art can prevent excessive friction between the
40 activatable hydrophilic layer and the printed label face
and also control the effect of ambient moisture levels
which may tend to cause label blocking and interfere with
the operation of high speed automated machinery which is

5 used to apply labels. These materials may be used at a
level of 0.2-5% by weight of the activatable layer
composition and/or the protective over coat applied over
the printed indicia on the side of the label opposite the
activatable layer and include materials such as
10 microcrystalline wax emulsions, erucamide dispersions,
polytetrafluoroethylene compositions, silicone beads,
modified silicone solutions, parafin wax emulsions, high
melting polypropylene emulsions, carnauba wax emulsions,
oxidized ethylene/EVA compositions, micronized
15 polyethylene wax/PTFE emulsions, micronized
polypropylene, micronized fluorocarbons such as PTFE
(Teflon), micronized polyethylene, silica and talc.

Protective coatings may be used to protect the paper and
20 printed indicia of the label when applied at a level of
0.25-4 lbs./3000 sq. ft. using conventional application
techniques. These materials include styrenated acrylics
such as OC1043 from O.C. Adhesives Inc., urethanes such
as AS455 from Adhesion Systems Inc., Flexcon Release
25 Varnish from Flint Ink. In a preferred embodiment, a
protective coating with release (non stick)
characteristics commonly known in the art is preferred as
the protective overcoat to prevent blocking if the stacks
of labels are exposed to moisture.

30 If an antistatic agent is employed in the printable over
coat applied over the indicia, it may be present at a
level
of 0.5-3% by weight of the dry coating. These materials
35 include quaternary ammonium salts such as Ethaquad C12,
sulfonated styrene maleic anhydride, sulfonated
polystyrene, sulfonated vinyl toluene maleic anhydride,
conductive polymers and organo modified silicones such as
Silwet L77. It is noted that anti-static agents are
40 typically not needed in the activatable layer because the
high moisture content of the animal glue provides
exceptional static elimination properties.

- 5 Optionally, if a metalized coating of a thin metal film is deposited on the printable surface of the paper sheets or rolls, premium quality decorative labels with all of the advantages set forth above will be provided.
- 10 It is clear that one specific activatable hydrophilic layer may not fit all applications but hydrophilic layers can be tailored to particular applications based on the conditions and requirements for wet PML labeling of activateable paper label substrates.

15

ACTIVATING SOLUTION

- Cross-linker 0-10wt%, preferably 1-10wt%; especially preferably, 2-4wt%
- 20 Wetting Agent 0-1wt%, preferably <0.5wt%
- Defoamer 0-1wt% preferably <0.5wt%
- Thickener 0-2wt%, preferably <1wt%
- Natural Polymers 0-15wt%, preferably 5-10wt%
- Synthetic Polymers 0-10wt%, preferably <5wt%
- 25 Water balance to 100%

Defined terms and tests are as follows:

- Wet Tack, - this is a measure of the initial adhesion of
- 30 the label to a surface immediately after activation and application to the surface and evaluated by trying to push or slide the label on the surface it was applied to.

- Ice Soak - Submersion of the labeled sample in an ice
- 35 water/cold water bath for 72 hours. After 72 hours, the labeled article is rotated in the bath cycles and labels are evaluated for edge flagging or removal.

- Edge Difficulty - this is a measure of the degree of
- 40 difficulty to lift the edge of the sample after it has

5 been allowed to dry and cure for a specified time period.
W denotes wet test after ice soak, D denotes dry test.

Adhesion Rating - this is a measure of the degree of bond
of the label to the surface when it is peeled back in a
10 slow continuous motion by hand and is performed right
after the edge difficulty test. If an ice soak test is
performed, this test is performed on sample pre and post
ice soak test.

15 Adhesive Action - defines whether the activatable layer
splits, stays with the label or transfers to the labeled
surface after the label is peeled back for the adhesion
rating test. If an ice soak test is performed, this test
is performed on sample pre and post ice soak test.

20 Curl - curl is defined as the degree the edges of the
label specimen lift when exposed to changing
environmental conditions in terms of temperature and
humidity.

25 Blocking - is defined as the degree of tack versus
separation of individual labels when the coated side of
the label is in contact with the opposite side in a
constant humidity chamber (92% RH) for 24 hours at room
30 temperature. Since different papers are used, for
comparative test purposes the non adhesive side was
always evaluated against the same Flexcon varnish from
Flint Ink.

35 All tests except Adhesive Action are rated on a scale of
0 to 3 where 0 is failure, 1 is poor, 2 is good and 3 is
excellent. Adhesive Action is denoted as A for paper
split or fiber tear, B stays on label, C transfers to
substrate to be labeled.

40 Animal glues are generically denoted in gram strength.

5 Approximate Coat Weight - is the theoretical coat weight
based on the solids of the coating and draw down road
size in grams/ MSI MSI = 1000 sq.in.

10 Type Of Paper Used - C1S denotes one side coated paper
C2S denotes two side coated paper

15 Activator Formulation details the formulation of the
activating solution.

Surface Labeled - G denotes glass.

20 The technique to prepare samples is as follows:

- 1 - Prepare Activateable Hydrophilic formulation
- 2 - Draw down Activateable formulation on selected paper
substrate
- 25 3 - Dry in lab forced hot air oven
- 4 - Prepare Activator Solution
- 5 - Apply Activator Solution with foam pad or brush to
activate with the minimum amount of solution to activate
the coating
- 30 6 - Rapidly apply the activated label to the surface to
be labeled
- 7 - Allow the applied label to dry/cure for 7 days.

35 All formulations are denoted by dry weight parts.

Example 1

40 Activatable Hydrophilic
Formulation - 30 parts 192 gram strength Animal Glue
 5 parts Urea
 5 parts Glycerine
 60 parts water

45 Paper Type - Metalized C1S

Approx. Coat Weight - 3.2 grams/MSI

50 Activator Formulation - 1 parts Polycup 172
 1 parts Glyoxal
 98 parts water

Substrate To Be Labeled - G

5

Example 2

10 Activatable Hydrophilic
Formulation - 30 parts 192 gram strength Animal Glue
 5 parts Urea
 5 parts Glycerine

15 Paper Type - C2S 60 parts water

Approx. Coat Weight - 3.2 grams/MSI

20 Activator Formulation - 1 parts Polycup 172
 1 parts Glyoxal
 98 parts water

Substrate To Be Labeled - G

25

I claim:

1. A process for applying a paper label to a glass,
plastic or metal container or surface said process
30 comprising:

35 (a) applying a layer of a hydrophilic solid material
comprising at least 30% by dry weight of an animal glue
based on the total weight of the hydrophilic solid
material to a paper label and thereafter drying said
layer of hydrophilic material to form a water activatable
hydrophilic layer that can be activated into a tacky
fastenable adhesive;

40 (b) applying a sufficient amount of water, water
containing a cross-linking agent, to said activatable
hydrophilic layer to form a tacky fastenable paper label;

45 (c) fastening said tacky fastenable paper label to a
glass, plastic or metal container or surface; and

(d) curing said paper label on said glass, plastic or
metal surface or container.

5

2.A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
1 wherein the hydrophilic solid material is 90 percent
by weight animal glue.

10

3.A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
1 wherein step (b) is carried out with the application
of a sufficient amount of water to said activatable layer
to form a tacky fastenable paper label.

15

4. A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
1 wherein step (b) is carried out with the application
of a sufficient amount of water containing an effective
amount of a crosslinking agent to said activatable layer
to form a tacky fastenable paper label.

20

5. A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
1 wherein step (b) is carried out with the application
of a sufficient amount of water containing an effective
amount of a crosslinking agent to said activatable layer
to form a tacky fastenable paper label.

25

30

6. A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
1 wherein step (b) is carried out with the application
of a sufficient amount of water based adhesive to said
activatable layer to form a tacky fastenable paper label.

35

8. A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
1 wherein step (b) is carried out with the application
of a sufficient amount of water based adhesive containing
a effective amount of a cross-linking agent to said
activatable layer to form a tacky fastenable paper label.

40

5

9. A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
1 wherein the total amount of dried hydrophilic material
is from 0.02g to 0.7g of dried hydrophilic material per
10 sq. cm. of paper label material.

10. A process for applying a paper label to a glass,
plastic or metal container or surface as defined in claim
9 where an slip agent is added to said hydrophilic
15 material.

11. A process for making a paper label stock for
application to a glass, plastic or metal container or
surface said process comprising:
20 (a) applying a layer of an hydrophilic solid material
comprising at least 30% by dry weight of an animal glue
based on the total weight of the hydrophilic solid
material by applying a aqueous dispersion comprising
animal glue to a paper label stock and thereafter drying
25 said layer of hydrophilic material.

12. A process for making a paper label stock for
application to a glass, plastic or metal container or
surface as defined in claim 11 wherein said aqueous
30 dispersion of animal glue contains a cross-linking agent.

13. A process for making a paper label stock for
application to a glass, plastic or metal container or
surface as defined in claim 12 wherein said aqueous
35 dispersion of animal glue contains a cross-linking agent
and an slip agent.

Abstract

The invention provides a method for fastening a pre-coated paper label to a glass, plastic or metal container or surface by means of a water based composition
10 containing at least 30% by dry weight of animal glue or natural or synthetic polymers that can be activated into an adhesive by the following steps: (a) applying a layer of a hydrophilic solid material based on at least 30% by weight on protein from animal renderings or natural or
15 synthetic polymers to a paper label substrate to form a hydrophilic layer that acts as an adhesive layer when activated with an aqueous medium; (b) applying a minimal amount of water or water containing a cross-linking agent to the activatable hydrophilic layer to activate said
20 activatable hydrophilic layer into an adhesive and form a fastenable paper label; (c) fastening the fastenable paper label to a glass, plastic or metal container or surface; and (d) allowing said the paper label to dry on the glass, plastic or metal container or surface.

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

01/31/2005 HTECKLU1 00000019 60646836

01 FC:2005 100.00 DP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 469-267/69033