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CARRIER WEB FOR THE FORMATION OF
THIN TRANSPARENT FILMS

Edouard M. Kratz, Gary, Ind., and Erich
Gebauer - Fuelnegg, Evansville, Ill., as-
signors, by mesne assignments, to Marbo
Products Corporation, Chicago, Ill., a cor-
poration of Delaware

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This invention relates to improvements in car-
rier webs or film forming bases for transparent
sheet material, according to which the surfaces
of such bases are rendered inert toward the
solutions from which said sheets are formed and
from plasticizers used in the under-layers of the
web.

More specifically, this invention relates to a
fabric carrier web having a smooth flexible coat-
ing of a plasticized cellulose-ester composition
anchored thereon and protected by a thin cover-
ing or barrier film which is not softened by the
action of solvents used in the solutions cast on
the web and which prevents the plasticizers from
working out to the surface.

In the application of Edouard M. Kratz, Serial
678,307, filed June 29, 1933, there is described
and claimed a carrier web for transparent sheet
material which is composed of a fibrous web
having a plasticized nitrocellulose coating an-
chored on the top surface of the web to present
a smooth, brilliant film forming base for the
transparent sheet material. In accordance with
the invention described in the application referred
to, a fabric material such as muslin or the like, is
coated with a cellulose ester film such as nitrocel-
lulose or cellulose acetate. The ester film is made
plastic by the incorporation of large amounts of
plasticizer, such as tri-cresyl phosphate, dibutyl
phthalate and other plasticizers which are well
known to the lacquer industry. The first coating
of the nitrocellulose is preferably pigmented to
obliterate and fill in any weave marks which
would most likely extend through a clear nitro-
cellulose film from the fabric material. Subse-
quent coatings need not be pigmented.

We have now found that while the carrier web
described in the Kratz application Serial No. 678-
307 possesses superior properties to prior art car-
rier webs, and is able to withstand continuous me-
chanical handling at high speeds without buck-
ling, this type of belt is not particularly adapted
to the formation of transparent films from solu-
tions if some component part of the solution is a
solvent for the plasticizer used in the nitro-
cellulose film. In other words, if a component
part of the transparent film solution has a tend-
ency to strike down into the carrier web and
leach out some of the plasticizer from the nitro-
cellulose film on the web, the exposed brilliant
surface of the web will ultimately be destroyed
and the carrier web will become hard and brittle.
A sheet cast thereon will be rough and uneven.
For example, if the transparent film solution con-
tained a solvent, such as benzol, there is a tend-

ency for the benzol to dissolve out the plasticizer
in the nitrocellulose film on the carrier web and
thus destroy the film rendering the web hard and
brittle. It is essential, however, that the nitro-
cellulose film be plasticized to prevent buckling
or cockling of the web during its mechanical
operation at high speeds on the sheet making
machine.

To prevent this solvent or leaching action of
film forming solutions on the plasticized cellu-
lose-ester web surface and to prevent the plas-
ticizers from working out of the under-coatings,
we now propose to cover this surface with a
barrier film of a material which is not affected
by the film forming solution or plasticizers used
in the under-coatings. This film, of course, is
not plasticized, but because of its extreme thin-
ness, it does not cause the carrier web to cockle
and buckle during the sheet forming operations.

Therefore, an object of this invention is to
provide a film forming base or carrier web for
transparent sheet material which will not cockle
or buckle at high speed operation and which has
a smooth, brilliant surface, inert toward the
action of film forming solutions cast thereon.

Another object of this invention is to provide
a carrier web for transparent sheet manufacture
which has a barrier film on its top surface pro-
tecting a highly plasticized under film.

Another object of this invention is to protect
the smooth brilliant, highly plasticized coating
on fabric backed carrier webs used in the manu-
facture of transparent sheet material.

Another object of this invention is to prevent
the leaching of plasticizers from the plasticized
nitrocellulose coatings on carrier webs by cover-
ing said coatings with a barrier film inert toward
the action of solvents in solutions cast thereon.

Another object of this invention is to provide
a film forming base for transparent sheet mate-
rial having a smooth protein surface covered with
a thin barrier film of unplasticized nitrocellulose.

Another object of this invention is to prevent
any leaching action of transparent sheet forming
solutions on film forming bases and to maintain
any plasticizers in said bases from working out
into the surface.

Other and further objects of this invention will
be apparent from the following description and
claims.

In order to form thin transparent films from
solutions, it is necessary to cast the solution on
some part of a traveling carrier medium to have
a continuous operation. The periphery of large
wheels may be used if the solvent in the film form-

ing solution can be driven off with sufficient rapidity so that the film is self-sustaining upon a single revolution of the wheel. However, it is practically impossible to thoroughly dry the film forming solution in a single revolution of even a very large wheel. Therefore, in order to obtain the proper drying time on the carrier medium, it is necessary to cast the solution on a traveling belt, and pass the belt through a drying device before stripping the film from the same and returning the belt to receive a new layer of solution thereon.

The production of suitable carrier belts has been a considerable problem in the art because the belt must be sufficiently soft and pliable to resist cockling and buckling and at the same time must be sufficiently resistant to abrasion and deforming scratches, such as are produced by the coating roller. The web must have sufficient thickness so that it can withstand mechanical handling over a period of time.

The casting surface itself must be perfectly smooth and brilliant and free from abrasions or scratches as the finished dry sheet cast on the web will faithfully reproduce any imperfections on the surface of the web. When the web is handled mechanically through the machine, it is necessary to bring the casting surface against a coating roller and this causes a wearing down or abrasion of the highly polished surface. It is, therefore, desirable to form a web which can be resurfaced by treatment with sandpaper or emery to smooth the same and remove any scratches therefrom. For the refinishing operation, grinding rollers are generally provided to rotate in a bath of naphtha or some other solvent and act directly on the surface in the same manner as the coating roll acts on the surface.

The carrier web as described and claimed in the Kratz application Serial No. 678,307 and composed of either a single or laminated muslin backing with successive coatings of pigmented and unpigmented nitrocellulose lacquers thereon, possesses all of the desirable properties. However, because of the large amounts of plasticizers which must be used in the nitrocellulose film to give the desired pliability to the web, as described above, the film forming solution deleteriously affects the plasticized film. It is the purpose of this invention to protect this film and maintain the plasticizer therein.

It should be readily understood that the barrier coating of this invention may be applied to any film forming base or carrier web which has its smooth brilliant surface deleteriously affected by a component part of the film forming solution, cast on the surface. For example, an oil baked web such as is described in the Kratz Patent 1,726,611 may also be treated and covered with a barrier film according to this invention. Film forming webs having smooth protein surfaces such as gelatin, casein, zein and the like can be rendered highly satisfactory for casting sheet forming solutions thereon by protecting their surface with a barrier film of nitrocellulose. Likewise, in some instances where the film forming solution does not dissolve proteins, a barrier coating of a protein material may be formed on top of the carrier web.

The following examples will illustrate specific adaptations of our invention.

Example 1

In casting a film forming material which is dissolved in benzol on a laminated fibrous web

covered with a nitrocellulose coating containing tri-cresyl phosphate as a plasticizer, it is desirable to have a barrier film composed of cellulose acetate dissolved in ethyl acetate coated over the plasticized nitrocellulose film. The barrier film of cellulose acetate is not destroyed or in any way affected by the benzol.

Example 2

For casting a film forming material dissolved in toluol on a carrier web which is composed of a fibrous material impregnated with tar or asphalt, it is desirable to have a barrier coating of cellulose nitrate disposed on top of the asphalt or tar coating.

Example 3

If the film forming material is dissolved in both benzol and toluol, and it is desired to form the sheet on a carrier having a smooth brilliant surface of baked enamel and a castor oil plasticizer, it is desirable to protect the baked enamel surface with a thin film of a hard phenol-aldehyde condensation product, such as "Bakelite C". This condensation product is inert toward the action of benzol and toluol and is sufficiently plastic because of the thinness of the coating on the plastic enamel, so that it will not cause the carrier web to buckle and cockle.

Example 4

For film forming material which is dissolved in alcohol, and is to be cast upon any flexible support, it is helpful to form a barrier film of "Resoglaz" on the support. This material is a polystyrene resin and is not affected by the alcohol.

Example 5

The film forming material dissolved in alcohol, as in Example 4, may also be cast upon a carrier web which is covered with a barrier film of a halogenated rubber composition, such as rubber chloride or rubber hydrochloride. Also, if desired, a vulcanized rubber coating composition may be used to protect the plasticized under film on the carrier web.

Example 6

The film forming material dissolved in alcohol may also be prevented from acting on the casting belt by coating the casting belt with various vinyl resins, such as those polymerized vinyl acetates and the like which are insoluble in alcohol.

Example 7

A film forming material dissolved in naphtha is prevented from acting upon a carrier belt having a smooth brilliant surface of a plasticized nitrocellulose composition by coating the nitrocellulose film with a polyhydric alcohol-polybasic acid resin, such as "Resyl", which is a glycerol ester of phthalic acid.

Example 8

If the film forming material is dissolved in ethyl acetate and is to be cast upon any flexible carrier web, it is desirable to cover the web with a barrier film of rubber or a rubber derivative.

Example 9

It is sometimes desirable to cast the transparent sheet forming materials on a protein surface. However, it may be necessary to protect this surface from the action of solvents in the sheet

forming solution and it has been found desirable to cover the protein material with a thin layer of unplasticized nitrocellulose. To anchor the nitrocellulose film securely onto the gelatin film, a thin coating of shellac is used as an adhesive.

The web is preferably built up as follows:

A coating of highly plasticized nitrocellulose is applied to a laminated fabric web and allowed to dry. A thin coating of filtered shellac is next applied. A gelatin coating is applied over the dried shellac to form a smooth brilliant surface. This surface can be covered with a thin coating of filtered shellac and the barrier film of unplasticized nitrocellulose applied thereover. The resulting web has a highly brilliant casting surface, is pliable and will not become brittle upon usage. This web is highly desirable for acting as a film forming base for transparent sheets made of rubber derivatives.

Example 10

A nitrocellulose casting surface may be applied on top of the barrier films described in the above examples. For instance, in cases where the fabric web has under coatings of highly plasticized nitrocellulose and a barrier coating of an inert resin or cellulose acetate or the like, a top surface film may be coated over the barrier film. The barrier film protects the plasticizer in the undercoats from softening the top coat and solvents in the film forming solutions which may penetrate into the top coat cannot pass through the barrier film to leach plasticizers out of the undercoats.

Example 11

Rubberized or rubber forming belts which are not too elastic may be protected with a barrier film of a protein material, such as gelatin, zein and the like. Solutions of film forming materials containing solvents which are not solvents for proteins may be cast on this type of belt.

From the above examples, it is evident that the barrier film is to be composed of a material which is not affected by any of the solvents or

component parts of the film forming solution. If the barrier film is to be plasticized, a plasticizer that is substantially inert toward the action of the film forming solution should be used. Thus, for example, if the film forming solution contains benzol as the solvent, triethylene glycol or blown drying oils, such as rape seed oil, may be used as a plasticizer for nitrocellulose or cellulose acetate in the barrier coat, since these materials are substantially insoluble in benzol at the temperatures used.

We are aware that numerous details of the process may be varied through a wide range without departing from the principles of this invention, and we, therefore, do not purpose limiting the patent granted hereon otherwise than is necessitated by the prior art.

We claim as our invention:

1. A casting belt for transparent sheet material comprising a laminated fabric web, a pigmented layer of a cellulose-ester composition thereon, a plurality of coatings of soft plasticized clear nitrocellulose composition above said pigmented layer to form a smooth, brilliant top surface and an inert barrier film on said surface to protect the under coatings from the action of solvents in the film forming solution to be cast on the belt.

2. A carrier belt for transparent sheet material comprising a fabric web, a coating of plasticized nitrocellulose on said web, a thin coating of shellac on said nitrocellulose, a layer of gelatin on said shellac, an additional thin coating of shellac superimposed on the gelatin layer and a top coating of unplasticized nitrocellulose.

3. A casting belt for forming transparent sheet material comprising a fabric web, undercoatings of highly plasticized nitrocellulose on said web, a barrier coating on said undercoating of material inert toward the action of plasticizers and solvents in the sheet forming solution and a top surface of unplasticized nitrocellulose.

EDOUARD M. KRATZ.

ERICH GEBAUER-FUELNEGG.