CURL RESISTANT FOIL TO PAPER LAMINATION AND METHOD OF MAKING SAME

3 Claims. (Cl. 156—280)

This invention relates to metallic foil to paper lamination and processes for producing such laminations, and more particularly to foil to paper laminations which are treated during their manufacture to reduce the tendency of the lamination to curl due to changes in relative humidity in the surrounding atmosphere.

The invention is especially directed toward the production of a lamination consisting of a layer of aluminum foil which is bonded to a paper backing. Laminations of this type are widely used for labels applied to bottles or packages. During the normal process of manufacturing such labels, the drying of the bonding media also dries or shrinks the paper backing. When the lamination is exposed to the atmosphere, as during storage, the paper picks up moisture from the atmosphere and swells. Since the aluminum foil member of the lamination is dimensionally stable to varying moisture content, swelling of the paper backing causes the lamination to curl with the foil on the inside of the curl. If the lamination is not properly dried or left too wet, then it gives off moisture to the atmosphere and the paper member shrinks. This causes the lamination to curl in the opposite direction.

This problem is particularly acute where the labels are prepared for use in automatic labeling machinery by cutting the labels to size and storing them in stacks.

Previously, the general practice in the industry has been to dry the completed lamination to a point where the moisture content of the paper backing is between 3 and 4 percent of the weight of the paper. This practice has been followed to avoid possible corrosive effects to the foil due to the presence of moisture in the paper. A paper backing having a moisture content of between 3 and 4 percent is in moisture equilibrium with the surrounding atmosphere at relative humidities in the range of approximately 10 to 15 percent. Since this particular range of relative humidity is abnormally low, it is apparent that foil to paper laminations are extremely susceptible to swelling by taking up water from the atmosphere when the laminations are exposed to relative humidities which ordinarily vary from between 30 to 80 or 90 percent. The swelling of the paper causes the lamination to curl, as described above, thus rendering the lamination difficult to handle, and in many cases making the lamination unsuitable for use in labeling machines or other types of equipment.

The primary object of my invention is to provide a foil to paper lamination which is resistant to curling over a wide range of relative humidity in the surrounding atmosphere.

Another object of my invention is to provide a method for producing a foil to paper lamination which is resistant to curling over a wide range of relative humidity in the surrounding atmosphere.

Other objects and advantages of the invention will become apparent by reference to the following specification taken in conjunction with the accompanying drawings.

In the drawings:

FIG. 1 is a schematic showing of an apparatus for producing a lamination in accordance with the invention; and

FIG. 2 is an enlarged view of a portion of the apparatus of FIG. 1.

In the drawings, one arrangement for producing a curl resistant foil to paper lamination according to the invention includes a supply roll of metallic foil 10 from which a continuous strip of metallic foil is fed to a bonding material applicator station 12. Foil from supply roll 10 is trained over an upper roll 14 at station 12, roll 14 being in rolling contact with a lower roll 16 which is partially submerged in a tank 18 containing the bonding material. Bonding material from the tank 18 is transferred from the surface of lower roll 16 to the surface of upper roll 14 from which it is applied to the lower surface of the metallic foil sheet.

Coated foil from station 12 and a continuous strip of paper from a paper supply roll 24 are fed between upper and lower pressing rolls 20 and 22. As the foil and paper strips pass between rolls 20 and 22, they are pressed into firm engagement with each other by the pressing rolls and the bonding material applied to the foil at station 12 bonds the paper and foil into a lamination.

The lamination is fed from the pressing rolls to a treating station 25 at which the lamination passes between upper and lower rolls 26 and 28 respectively. Lower roll 28 is formed with a surface of a resilient material such as rubber and is mounted to rotate partially submerged within a bath 30 of treating solution. Upper roll 26 is constructed from steel and is located to exert a cushioned squeezing action on the lamination by pressing the lamination firmly against the rubber surface of roll 28.

Rotation of roll 28 in the indicated direction carries treating liquid upwardly into contact with the lower or exposed surface of the paper. To completely flood the exposed surface of the paper with treating solution, a blade 32 extends beneath the path of the lamination to act as a dam which maintains a substantial supply of treating solution in position to be contacted by the paper as it passes between rolls 26 and 28 by trapping treating solution squeezed from the paper as the lamination passes between rolls 26 and 28.

From the treating station, the lamination is passed through a drying chamber 34 and from drying chamber 34 to a take-up roll 36.

An important feature of the process resides in regulating the moisture content of the paper as it passes on to take-up roll 36. To measure the moisture content, an electronic moisture meter 38 is located to measure the moisture content of the paper as it passes from the drying chamber to the take-up roll. Suitable meters of this type are commercially available; one well-known type measures the moisture content by measuring the electrical resistance of the paper, the electrical resistance varying with the amount of moisture in the paper.

In accordance with this invention, the moisture content of the paper should be between 5% and 7% of the weight of the paper as the lamination is passed from drying chamber 34 to take-up roll 36. The moisture content of the paper at this point may be adjusted by observing the moisture content measured by meter 38 and regulating the speed at which the lamination is moved through drying chamber 34 or by adjusting the temperature within chamber 34.

The composition of treating solution applied to the paper is determined, at least in part, by the use to which the lamination is to be put. Basically, the treating solution is applied for the purpose of reducing the ability of the paper to take up moisture. Many agents for this purpose are commercially available.

Treating solutions which are suitable for use in the above-described process may be divided generally into three types: stabilizers, sizers, and humectants. Each of the three different types of treating agents acts to prevent the paper from taking up moisture in a slightly different manner. In a simplified manner, the actions of the re-
spective agents may be distinguished by stating that in general stabilizers chemically combine with the paper in a manner which reduces the volume of space within the paper where moisture may be received. Sizers act to form a water resistant coating on the surface of the paper and thus prevent moisture from penetrating into the paper. Humectants in general act to attract the moisture to themselves and prevent the moisture from soaking into the paper fibers.

In general, a foil to paper lamination having satisfactory curl resistant tendencies may be manufactured by a process which includes treatment with an agent falling into any one of the above types. The type of agent eventually selected is one whose effects, aside from its moisture control characteristics, on the finished product are of interest. For example, many sizers impart a certain stiffness or rigidity to the finished product. This property is often desirable where relatively thin or light weight paper stock is employed. Thus, assuming that agents of each of the three different types mentioned above of equal effectiveness in reducing the ability of the particular paper in question to take up water were available, the sizing agent would be chosen where stiffness or rigidity in the finished product was desirable. If stiffness is undesirable in the finished product, the humectant type agent would probably be chosen.

In order to obtain optimum curl resistant characteristics in the completed lamination, it is necessary to adjust or regulate the moisture content of the paper to fall within the range of between 5% and 7% of the weight of the paper at the completion of its manufacture. This particular range is a departure from previous practice in which the completed lamination is conventionally dried to a moisture content of between 3 and 4 percent of the weight of the paper. A final moisture content of between 3 and 4 percent has been previously thought desirable in order to assure against possible corrosive effects to the metallic foil because of the presence of the moisture in the paper. Experience has proven that the possibility of corrosion is not increased by any practical extent at moisture contents of between 5% and 7%. It has been found desirable to achieve a moisture content of at least 5% in the finished lamination since the tendency of the completed lamination to curl increases at moisture contents below 5%.

Since the treating agent is usually applied in the form of a water solution the final moisture content of the paper is easily achieved by drying the lamination after the treating solution has been applied to the paper. The following examples represent typical practices of the process.

(1) Paper stock bonded to a thin aluminum foil was treated in the manner described above with a 10% sugar solution. The treated lamination was dried to a moisture content of 6% and subsequently exhibited satisfactory curl resistant properties when exposed to various humidity conditions.

(2) Paper stock bonded to thin aluminum foil was treated in the manner described above with a 5% Stab-U-Cel solution. Stab-U-Cel is an organic ester manufactured by the Upson Chemical Corporation. After treatment, the lamination was dried to a final moisture content of 6%. Label stock cut from the treated lamination exhibited satisfactory curl resistant properties when tested over relative humidities ranging from 30 to 80%. The curl resistant properties were slightly improved over those obtained in Example 1 above.

(3) Paper stock bonded to thin aluminum foil was treated with a 1% Aquapel solution. Aquapel is manufactured by the Hercules Powder Company and is composed of approximately equal parts of stearic acid and palmitic acid to which an emulsifying agent is added. After treatment the lamination was dried to a moisture content of 6%. Labels cut from this stock exhibited satisfactory curl resistant properties slightly improved over those obtained in Example 2 above when exposed to similar humidities.

It should be emphasized that the foregoing examples are merely representative. Basically, the achievement of a metallic foil to paper lamination having satisfactory curl resistant characteristics is dependent upon the combination of a treatment which reduces ability of the paper to take up moisture combined with a subsequent adjustment of the moisture content of the paper to achieve a moisture content of between 5% and 7% of the weight of the paper, the optimum moisture content being 6%.

The foregoing description is to be considered exemplary rather than limiting, and the true scope of my invention is that defined in the following claims.

I claim:
1. The method of making a foil to paper lamination for use as a label or similar article having improved curl resistant properties when stored in stacks comprising the steps of bonding the paper to the foil, treating the exposed surface of the paper to reduce the ability of the paper to take up moisture, and subsequently adjusting the moisture content of the paper to between 5% and 7% of the weight of the paper.

2. The method of making a foil to paper lamination for use as a label or similar article having improved curl resistant properties when stored in stacks comprising the steps of bonding the paper to the foil, treating the exposed surface of the paper with a solution containing a treating agent operable to reduce the ability of the paper to take up moisture, and subsequently drying the lamination to reduce the moisture content of the paper to between 5% and 7% of the weight of the paper.

3. The method of making a foil to paper lamination for use as a label or similar article having improved curl resistant properties when stored in stacks comprising the steps of bonding the paper to the foil, treating the exposed surface of the paper with a solution containing a treating agent operable to reduce the ability of the paper to take up moisture, and subsequently drying the lamination to reduce the moisture content of the paper to substantially 6% of the weight of the paper.

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