

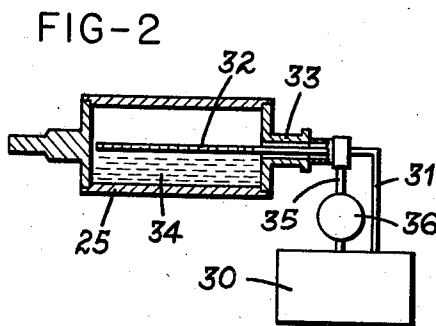
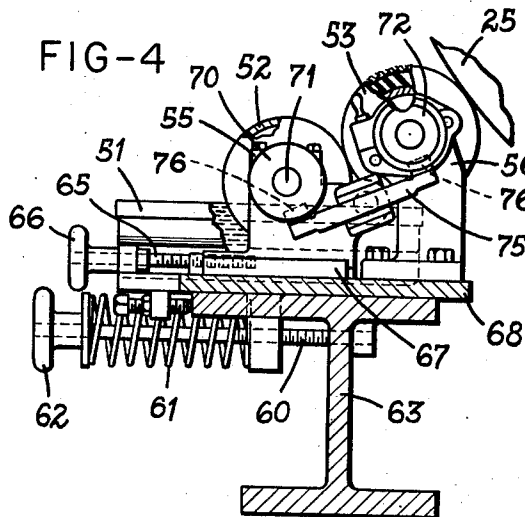
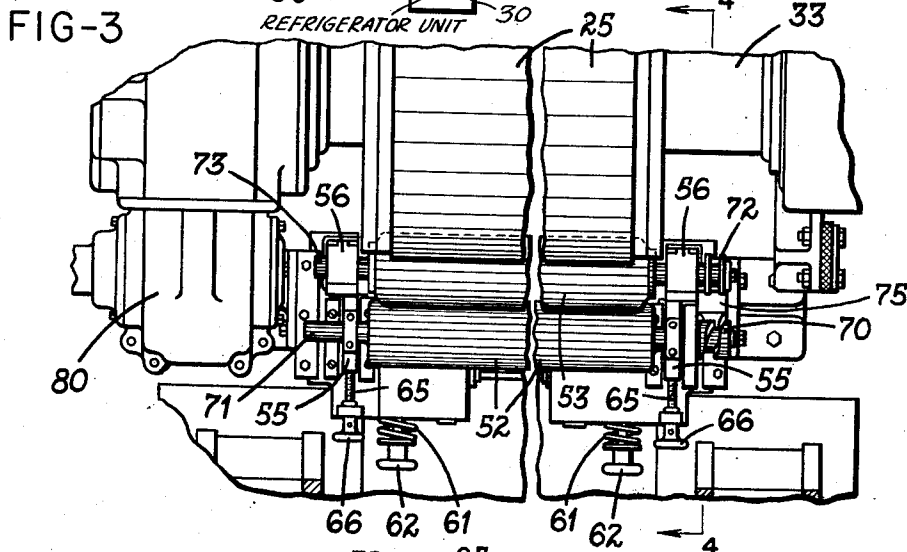
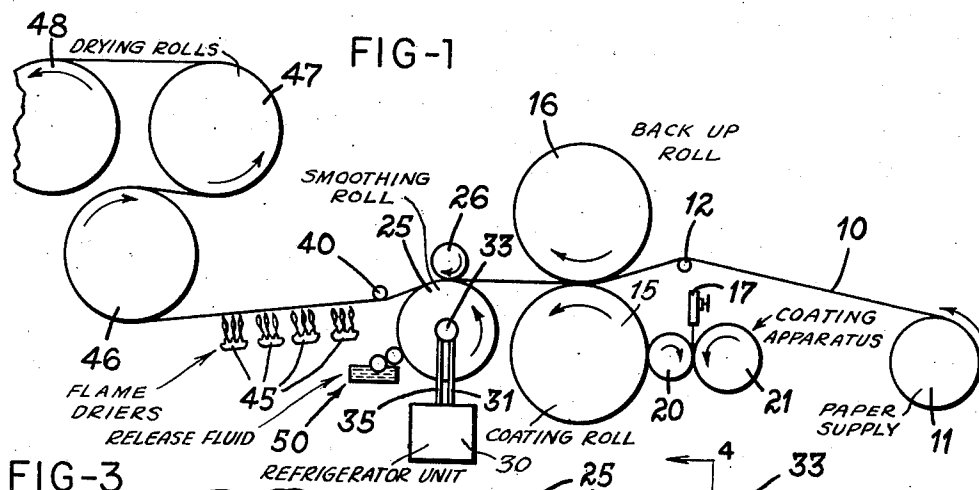
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J. C. REDD

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METHOD OF COATING AND SMOOTHING PAPER

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INVENTOR
JOHN C. REDD
BY *Marshall Beibel French & Burg*
ATTORNEYS

1

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METHOD OF COATING AND SMOOTHING PAPER

John C. Redd, Chillicothe, Ohio, assignor to The Mead Corporation, Dayton, Ohio, a corporation of Ohio

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13 Claims. (Cl. 117-64)

This invention relates to the manufacture of coated paper, and more particularly to paper having surface finished coating applied thereto and smoothed and stabilized by contact with a refrigerated smoothing member according to a process generally of the character described in Patent No. 2,647,842 of R. N. Griesheimer and R. C. Hydell, issued August 4, 1953, to the same assignee as this application.

One of the objects of this invention is to provide a method for producing coated paper having smooth surface characteristics adapted for receiving printing in which the applied coating material on the paper is smoothed by contact with the treated surface of a refrigerated smoothing member and stabilized against adhesion to the smoothing member by freezing or substantially reducing the temperature of the coating by the refrigerated member so that the smoothed and stabilized coating is separated from the smoothing member without adhesion thereto and without splitting of the coating film.

Another object of this invention is to provide a method for producing coated paper of the character described in which a film of release fluid is supplied to the refrigerated freezing member before it contacts the coating whereby substantially complete release of the coating from the smoothing member is effected after smoothing and freezing or stabilizing the coating without adhesion to the smoothing member.

Still a further object of this invention is to provide in a method for coating paper of the character described means for controlling the wetting and adhesion of the fluid coating for a refrigerated smoothing member whereby the fluid coating is smoothed and frozen or immobilized at reduced temperature without adhesion to the smoothing member and without splitting of the coating film upon separation thereof from the surface of the smoothing member.

Another object of this invention is to provide apparatus for practicing a method of coating paper of the character described having a refrigerated smoothing member for blending, smoothing and freezing or immobilizing fluent coating in contact therewith by reducing the temperature of the coating substantially without drying, and having means for interposing between the refrigerated smoothing member and the fluent coating a film of release fluid for controlling wetting of the smoothing member by the coating and for effecting substantially complete release of the stabilized coating from the smoothing member without adhesion thereto.

Another object of this invention is to provide a method for coating paper on roll coating apparatus of the character described, which paper has, without supercalendering, surface smoothness characteristics comparable to roll coated papers after supercalendering.

Still another object of this invention is to provide a method for roll coating paper of the character described to provide coated paper with a dull finished surface without supercalendering, but with surface smoothness

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characteristics comparable to supercalendered high finished coated papers.

Still another object of this invention is to provide a method for coating paper of the character described in which a fluent coating film on the paper is contacted with a refrigerated smoothing member while the film is still mobile and fluent and the film is blended and smoothed in contact with said smoothing member and immobilized by being frozen or subjected to the reduced temperature of said refrigerated smoothing member effecting substantially complete release of the immobilized film from said smoothing member without adhesion thereto, which method also includes interposing between said film and said smoothing member a thin film of release fluid assuring complete release of said coating film from said member substantially without splitting of said coating film.

Other objects and advantages of this invention will be apparent from the following description, the accompanying drawing, and the appended claims.

In the drawing, which illustrates apparatus embodying, and found satisfactory for practicing the inventions hereof—

Fig. 1 is a diagrammatic view in side elevation showing apparatus constructed in accordance with and for carrying out the practicing of this invention;

Fig. 2 is a diagrammatic view partly in section of one means of refrigerating the smoothing member according to this invention;

Fig. 3 is a view on a somewhat larger scale illustrating a preferred method of applying the release fluid to the refrigerated smoothing member of apparatus for embodying and practicing this invention; and

Fig. 4 is a view in section along the lines 4-4 of Fig. 3.

In the coating of paper in high speed roll coating apparatus, the coating material or "color" may be applied to the surface of the paper by coating application rolls. If the coating color comprises a finely divided mineral coating pigment and an adhesive therefore, it is satisfactorily applied to the paper as an aqueous suspension or slurry. Particularly with high speed operation, it may be desired to have the solids content of the aqueous suspension as high as possible within the practical limits of the apparatus.

Accordingly, at the point of application of the color to the paper, the color may be in the condition of a more or less viscous or sticky but fluent slurry. In such a case, the paper is brought into contact with a film of the fluent color on the color applying roll from which a coating film is transferred to the paper. Because of the adhesive characteristics of the color, however, the entire film on the roll may not be transferred to the paper—i. e., the film on the roll may split as the paper and roll surface separate, leaving part of the color still on the roll and another part adhering to the surface of the paper.

Because of the viscosity and other properties and characteristics of the color, such a film split may leave on the exposed surface of the film on the paper a substantially uneven or rough surface exhibiting a configuration known as "piling" or "worming" which, if immediately dried, produces a coated surface which is too rough or non-planar to meet the exacting requirements for surface smoothness of fine printing impressions such as multi-color half tone printing found in magazine illustrations, and the like.

If it is attempted to contact such rough applied coating surface with a smoothing member while the coating is still fluent and mobile on the paper, an additional film split may occur when the coated paper is separated from the smoothing member, thereby disrupting whatever smoothing action may have been effected by the smoothing member.

According to this invention, a fluent coating color is applied by roll coating apparatus of the character described to a traveling paper web. Then, the coated surface of the web is pressed against a smoothing member while the coating on the web is still mobile and fluent, effecting blending of the coating on the web and smoothing of the surface thereof. The surface of the smoothing member is covered with an applied film of release fluid for controlling wetting and adherence between the coating and the smoothing member. While the mobile and fluent coating is in contact with the smoothing member, its temperature is substantially reduced effecting immobilization or actual freezing of the coating in its blended and smoothed condition whereby the paper with the immobilized coating thereon may be separated from the smoothing member without disrupting the smooth surface characteristics imparted thereto and without a coating film split or other result of adhesion to the smoothing member. The immobilized coating may then be thawed and dried in the usual manner, producing a coated paper product of the character described with extremely smooth surface characteristics.

Satisfactory results have been obtained with the methods according to this invention using a so-called thixotropic coating color comprising finely divided mineral coating pigment and, for example, a starch adhesive material admixed together in an aqueous suspension. Such suspensions are supplied to the color application rolls and may be conditioned under pressure in the nips between the various rolls to achieve a substantially fluent condition upon application to the paper and, after having been applied to the paper, will set up or become substantially less fluent until they are finally completely immobilized by removal of the water from the aqueous suspension by drying the coated paper.

Referring to the drawings, which illustrate somewhat diagrammatically apparatus which has been satisfactorily used embodying and for practicing this invention under commercial operating conditions, Fig. 1 shows a diagrammatic side elevation. The paper web 10 to be coated is indicated as coming from a roll 11 and passing over a guide roll 12 through the nip between the coating roll 15 and backup roll 16. The coating suspension is supplied by suitable apparatus 17 to a pool between metering and conditioning rolls 20 and 21. The coating suspension, more particularly described hereinafter, receives high shear working in the pool and in the nip between rolls 20 and 21, and a film of coating material is transferred by roll 20 and metered onto the surface of coating applying roll 15, from which it is transferred to one surface of the web 10 as it passes through the nip between rolls 15 and 16.

After leaving rolls 15 and 16, the web 10, with the coating applied thereto, contacts the refrigerated smoothing member 25 against which it is pressed by back-up roll 26. Satisfactory results have been obtained with this smoothing member being a roll with extremely smooth or polished surface of chromium, or the like. The smoothing roll 25 is refrigerated, as indicated diagrammatically in Fig. 2, by, for example, the circulation of refrigerated brine therethrough. A refrigerated unit is shown diagrammatically at 30 from which refrigerated brine is introduced into the roll 25 through inlet pipe 31 and sprayed against the inside of the roll by means of the spray 32 entering through the hollow hub 33 of the roll 25. Brine collecting in the roll at 34 is drawn out through the hollow hub 33 by means of the outlet pipe 35 and recirculated through the refrigeration unit by pump 36 to be re-cooled.

The extent to which the web 10 and the coating on the surface thereof remains in contact with the smoothing roll 25 (i. e., the amount by which the web "wraps" roll 25) is controlled by the positioning of guide roll 40. After separating from roll 25, the web passes over drying means 45, here shown diagrammatically as flame driers,

or other suitable means which will direct heat or hot air to the coated surface of the web for thawing and/or at least partially drying the coating thereon without contacting the coated surface thereof. The web then passes over conventional drying drums 46, 47, 48, etc.

It will be noted that the distance between the nip of coating applying rolls 15, 16 and the refrigerated smoothing roll 25 is maintained so that the coated web will contact roll 25 while the coating thereon is still mobile and fluid. Also the distance between refrigerated smoothing roll 25 and the first subsequent contact of any portion of the apparatus with the coated surface of the web (e. g. drier drums 47, 48) is maintained so that the coating will have become sufficiently dried or immobile so that the smooth surface imparted thereto by roll 25 will not be disrupted when the coated surface contacts drier drum 47. This can satisfactorily be achieved by utilizing a more or less thixotropic coating which will automatically set up somewhat after leaving the applying and blending zones where high shear working is imparted thereto and by correlating the internip transit time of the coated web with this characteristic of the coating, as well as partially drying the coating with driers 45 and by contacting the uncoated side of the web 10 first against drier drum 46 before the coated side of the web 10 is brought into contact with any portion of the apparatus.

Positioned adjacent the refrigerated smoothing member 25 is release fluid applying means indicated generally in Fig. 1 by the numeral 50 and shown in a somewhat larger scale in Figs. 3 and 4. This apparatus comprises a trough 51 containing the release fluid described hereinafter. A roll 52 dips into this trough and picks up release fluid therefrom which it transfers to the surface of roll 53 which in turn transfers a film of the release fluid to the surface of refrigerated smoothing roll 25. The back-up roll 52 is journaled in bearings 55 while the applicator roll 53 is journaled in bearings 56. Adjustable pressure means comprising a screw 60, operating against a spring 61 and adjusted by a handwheel 62 with relationship to the main support beam 63 provide adjustment of the release fluid applying apparatus with respect to the surface of smoothing roll 25. Additionally adjusting means comprising a screw 65, handwheel 66 and a slide mounting 67 carrying bearing 55 slidably on the base plate 68 provide additional adjustment of the pick-up roll 52 with respect to release fluid applying roll 53. The correlation of these several adjustment means, and the consequent variation of pressure between rolls 52, 53 and 25, provide for metering and controlling the amount of the release fluid applied to the surface of the roll 25.

A cam member 70 on the shaft 71 of roll 52 and a pulley member 72 on shaft 73 of roll 53 cooperate with an arm 75 having two guides 76 to produce longitudinal oscillation of roll 52 with respect to roll 53 whereby the release fluid is transferred from the trough 51 in a uniform manner to roll 53 and thence to roll 25. The release fluid applying mechanism is driven by suitable means indicated at 80 and, as it will be understood by men skilled in the art, the various other driven rolls in the apparatus heretofore described are driven by suitable and conventional well-known means not shown in detail.

Satisfactory results have been achieved according to this invention with the various rolls of the apparatus hereinabove described having diameters, surface layer characteristics, plastometer readings, etc., as follows:

- Roll 15—30" diameter, rubber covered 70 P. & J.
- Roll 16—30" diameter, metal surface
- Roll 20—10½" diameter, chrome surface
- Roll 21—16" diameter, rubber covered, 49 P. & J.
- Roll 25—24" diameter, chrome surface
- Roll 26—9½" diameter, rubber covered, 30 P. & J.
- Roll 40—2½" diameter, soft rubber covered
- Roll 52—4" diameter, metal
- Roll 53—4¼" diameter, fabric cover over rubber

As an example of satisfactory operation under commercial conditions according to this invention, a coating color having the following composition:

	Parts by weight
Chlorinated starch adhesive-----	13
Fine particle size domestic coating clay-----	17
Fine particle size calcium carbonate-----	70
Sodium hexametaphosphate dispersant-----	0.5
Calcium stearate-----	0.5
Vegetal-----	1.0

admixed with water to give an aqueous suspension with 63% solids was supplied at a temperature of 93° F. and at web speeds of from 555 to 560 feet per minute to produce a coat weight of 16 pounds per side per ream of 500 sheets 25" by 38". The pressure between rolls 15 and 16 was adjusted sufficiently high to produce a nip approximately 3/4" wide, while 40 pounds per linear inch metering pressure was applied between rolls 20 and 21, and 100 pounds per linear inch between rolls 20 and 15, and approximately 150 pounds per linear inch pressure between the refrigerated roll 25 and the back-up roll 26.

Smoothing roll 25 was refrigerated by a two stage refrigeration system circulating through roll 25 at the rate of about 120 gallons per minute brine supplied at a temperature of about -29° F. The release fluid in trough 51 and supplied by the release fluid apparatus 50 comprised 30% ethylene glycol, 30% ethylene glycol with rust inhibitor (e. g., automotive antifreeze such as is manufactured under the trade-name "Prestone" by Carbide and Carbon Chemicals Corporation), 30% water, and 10% denatured alcohol (ethanol) at the rate of approximately one pint of release fluid per 40 minutes running time at 550 feet per minute to produce a release fluid film on roll 25 of approximately 0.0036 mil thickness.

As noted above, one the principal objects of this invention is to achieve smoothing of a still fluent and mobile coating film while avoiding a film split in the coating when the coated web leaves the smoothing member. This is also achieved according to this invention without drying the coating and without imparting to the finished coated surface a substantial degree of gloss or luster.

While the exact mechanics of the physical and chemical changes occurring in the coating may now not be known with certainty, useful hypothesis can be made. For example, it is not known whether the coating is actually frozen all the way through, although the surface thereof leaving the freezing roll 25 appears to be frozen. In fact, it may be that whether the coating is actually frozen all the way through depends upon a number of separate variables.

For example, it appears necessary to freeze or immobilize by refrigerating at least the surface layer of coating so that any adhesion of the coating for the smoothing roll is less than the cohesion within the coating in order to avoid a film split in the coating. With very fast freezing (e. g., a colder roll) it may be sufficient to freeze the surface portion only of the coating before any wetting of the roll by the coating occurs. Thereafter the internal unfrozen cohesion may well exceed the adhesion of the frozen surface for the treated surface of the smoothing roll or the release fluid film thereon. With a warmer roll, on the other hand, it may be necessary to freeze throughout the coating since the warmer roll means slower freezing with, consequently, more time for the surface of the coating to wet the roll. In any case, regardless of the actual rate of freezing, the internal cohesion of the coating should be more than the adhesion of the coating for the surface of the smoothing roll or the release fluid film thereon in order to avoid a film split in the coating, and it will be understood that faster freezing reduces both such adhesion and cohesion but apparently at different rates.

Also, in considering various operational factors of a

process embodying this invention, it should be noted that a warmer roll requires longer contact with the coating (i. e., longer wrap) for adequate cooling and, perhaps a consequent slower web speed. Similarly, higher coating solids seem to indicate a faster immobilizing for a given coat weight, apparently because of the presence of less water to be frozen. Higher speeds, on the other hand, mean less internip transit time between the application nip and the freezing nip, thus permitting less penetration of the coating into the paper and more water on the surface of the paper to be frozen or cooled. However, if the refrigerated roll is too cold or the web speed too slow, the coating film on the web may stiffen too quickly for adequate blending and smoothing of the coating prior to immobilization by refrigeration. Similarly the weight of coating applied to the web contributes its effect to the extent of cooling required since a higher coat weight means a larger heat reservoir to be cooled before even the surface layer is frozen or immobilized, thus indicating a slower speed and/or lower refrigerating temperature. It has been noted, for example, that an increase of solids content of the coating of but a few percent admits of a substantial increase in web speed for the same smoothing roll surface temperature. In general, with solids content in the range of about 55% to 60%, and speeds in the range of 450 to 600 feet per minute, satisfactory results have been obtained with the surface temperature of smoothing roll 25 within the range of about -4° F. to 15° F.

The utilization of the release fluid according to this invention substantially broadens the extent of operational tolerances, giving increased operational latitude with respect to web speed, roll temperatures, coat weight, solids content, starch content and its effect on water binding properties, etc. In general, the release fluid employed is such as to resist undesired admixture with the fluent coating at least under the conditions of contact between the coating and the release fluid on roll 25 and in the nip between rolls 25 and 26. If such admixture is not avoided or inhibited to a substantial degree under such conditions, the release fluid may itself be so incorporated in the coating during the blending thereof in the nips between rolls 25 and 26 as to lose its releasing function and/or to become admixed in the coating with perhaps adverse effects. Thus, while complete immiscibility of the release fluid with the coating is not necessary, the fluid is one with which such admixture will not occur to a substantial extent under the particular conditions encountered. On the other hand, the release fluid is such that any proportion thereof which is admixed or carried away from roll 25 with the coating on the web will not have a deleterious effect thereon, impart odor or color, or other undesired characteristics to the coated paper. The desired degree of such resistance by the release fluid to incorporation with the coating is greater than for higher operating temperatures of roll 25 where a longer time is required to stabilize the coated surface sufficiently to prevent undesired admixture of the fluid with the coating.

The release fluid according to this invention has a low freezing point and low viscosity at the low temperatures of the roll 25. Also it readily wets the surface of roll 25 in order to be applied thereto in a substantially continuous film, and provides a film which can readily split and/or from which the coating will readily separate with substantially less force than that required to cause a film split in the film of coating on the web. It has been observed that a release fluid according to this invention may have a tendency to level minute surface irregularities in the roll 25 thus preventing entrapment therein of the frozen coating and consequent adhesion to roll 25 of bits of frozen coating. Also, the release film may actually prevent the coating film on the web from wetting the surface of roll 25 before it is frozen. It has been observed that coating materials embodying this invention have a greater tendency to adhere to roll 25 if they have had an

opportunity to wet the roll before the surface portion of the coating is frozen.

Satisfactory results have been obtained with various low freezing point fluids, although the mixture of ethylene glycol, water, and alcohol set forth above is preferred. Undiluted glycols and glycol-water mixtures having 40% to 60% glycol have also given satisfactory results. Especially with extremely low temperature operation of roll 25, a glycol-water mixture in eutectic proportions provides the low freezing point desired. Diethylene glycol and other glycols are also satisfactory as well as low freezing point hydrocarbons, ethers, higher alcohols, and liquid organic salts. As well as having adequately low freezing points, however, the release fluid components according to this invention also have adequately high boiling points at least above approximately 125°-150° F. for satisfactory operation under commercial conditions in the paper mill where room temperatures in the summer time may range well over 100° F. Yet the boiling points are low enough so that any release fluid actually carried away from roll 25 by the paper may be eliminated along with water in the coating by the drying apparatus. Also such release fluids are non-toxic and substantially non-flaming. Thus ethanol alone or an ethanol-water mixture gives satisfactory results but is not preferred because of the fire hazard. Many other liquids having adequately low freezing points and adequately high vapor pressures to meet the requirements of operating conditions are not preferred because they impart an odor or color to the coated paper or otherwise undesirably affect the final product. Release fluids according to this invention also have relatively low viscosities at the low operating temperatures of roll 25 as well as relatively small changes of viscosities with temperature in the operating ranges and wetting characteristics for the surface of the refrigerated roll such that they may be spread thereover to form a substantially continuous film or an interposed leveling or splitting layer preventing sufficient wetting or contact or adhesion of the coating with the roll surface to preclude substantially complete release of the coating from roll 25.

Sufficient of the release fluid is metered on to the surface of roll 25 to avoid frost formation thereon and to assure complete release of the coated web for all operating conditions. The exact amount used will, of course, vary for different coat weights, different coating colors, and different roll temperatures and speeds, as well as such varying conditions as room temperature, humidity, etc. In general, however, the release fluid applying mechanism should be adjusted so that sufficient fluid is metered on to the surface of roll 25 to avoid a "frying" sound as the coated web releases from the roll. This provides a satisfactory operating indication for an appropriate amount of release fluid. If too much release fluid is added, a distinct softening or mushiness or wrinkling can be noted in the surface of the coating on the web coming from roll 25 and even admixture of the fluid with the coating enough to soften the coating and permit a film split therein. Although, in most instances, the range between the "frying" sound referred to and a noticeable wrinkling or softening of the coating is quite broad, these two readily observable characteristics provide satisfactory quantitative indications for ready application and metering of the release fluid in a process according to this invention. For example, satisfactory results have been obtained using one quart of fluid per 5 minutes running time at 600 feet per minute to give a film thickness on roll 25 of 0.045 mil as well as with the preferred lower fluid application rate mentioned above.

The smooth surface characteristics imparted to the coating on the web 10 by the smooth surface of the roll 25 are retained upon leaving the roll 25 without a coating film split in contrast to conventional roll coating processes. Therefore, a coated paper product is produced according

to this invention which, without supercalendering, achieves surface smoothness characteristics comparable to those which can only be achieved by supercalendering the coated product of conventional roll coating processes. For example, a satisfactory coated product has been produced according to this invention having surface smoothness characteristics, without supercalendering, corresponding to a value above 200 in the standard Bekk smoothness test, whereas supercalendering gives an additional smoothness corresponding to a value above 300 Bekk. This enhanced characteristic of a process embodying this invention permits the production of extremely smooth dull coated papers because, as is well-known, the supercalendering heretofore necessary in order to achieve adequate smoothness adds considerable gloss to the paper. With a process embodying this invention, not only is this additional gloss eliminated by eliminating the need of supercalendering, but additional dull finished characteristics are imparted to the smoothed coating apparently by virtue of thawing the coating before drying as it passes over the hot air driers 45.

Furthermore, the elimination of the need for supercalendering further enhances the appearance of paper produced according to this invention by eliminating the base stock formation mottle which is conventionally emphasized by supercalendering. Since there is no coating film split upon leaving the roll 25, the surface of paper produced according to this invention is substantially free of the pile pattern of conventional roll coated papers. Particularly with dull coated paper produced according to this invention the paper is also free of any contour patterns produced from knurled calendar rolls heretofore used to give the appearance of a dull coated sheet. For example, an uncalendered paper produced according to this invention has an extremely dull finish corresponding to a value as low as 7 or 8 and certainly less than 15 by the standard Bausch and Lomb glossmeter test, and a finish corresponding to a value as low as 20 by the standard Ingersoll glarimeter test, whereas supercalendering the same paper raises the glossmeter value to as much as 50 and the finish value to as much as 42.

While the methods and forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise methods and forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In the coating of paper to produce surface characteristics adapted for receiving printing and the like, the method of forming a smooth surface on a layer of fluent coating composition applied to paper which comprises the steps of smoothing the surface of said applied coating with a smoothing member maintained at a low temperature for immobilizing said coating against adhesion to said member to provide substantially complete release of said smoothed coating from said member, applying to the surface of said smoothing member a film of a water soluble release fluid prior to contact between said surface of said smoothing member and said coating for inhibiting wetting of said surface by said coating and adhesion thereto, said release fluid being adapted to wet the surface of said smoothing member and having a freezing point substantially lower than said low temperature, thereafter separating said paper and applied coating from said member, and drying said coating on said paper.

2. In the coating of paper to produce surface characteristics adapted for receiving printing and the like, the method of forming a smooth surface on a layer of fluent coating composition applied to paper which comprises the steps of smoothing the surface of said applied coating with a smoothing member maintained at a temperature substantially below the freezing point of said coating for

immobilizing said coating against adhesion to said member to provide substantially complete release of said smoothed coating from said member, applying to the surface of said smoothing member a continuous film of a water soluble release fluid prior to contact between said surface of said smoothing member and said coating for inhibiting wetting of said surface by said coating and adhesion thereto, said release fluid having a freezing point substantially below said temperature of said smoothing member and a boiling point not substantially higher than the boiling point of water, thereafter separating said paper and applied coating from said member, and drying said coating on said paper.

3. In the coating of paper to produce surface characteristics adapted for receiving printing and the like, the method of forming a smooth surface on a layer of fluent coating composition applied to paper which comprises the steps of smoothing the surface of said applied coating with a smoothing member maintained at a temperature substantially below the freezing point of said coating for immobilizing said coating against adhesion to said member to provide substantially complete release of said smoothed coating from said member, applying to the surface of said smoothing member a continuous film of a water soluble release fluid prior to contact between said surface of said smoothing member and said coating for inhibiting wetting of said surface by said coating and adhesion thereto, said release fluid including an organic liquid having a freezing point substantially below said temperature of said smoothing member and a readily fluid viscosity at said temperature, freezing at least the surface of said coating, thereafter separating said paper and applied coating from said member, and drying said coating on said paper.

4. In a process of making coated paper of the character described wherein an aqueous coating composition is applied to the surface of said paper and brought into contact with a smoothing member, the steps of applying to the surface of said smoothing member prior to contacting said coating a film of a water soluble release fluid for inhibiting wetting of the surface of said smoothing member by said coating, reducing the temperature of said smoothing member effecting stabilization and immobilization of said coating against adhesion to said smoothing member, separating said paper and applied coating from said member with substantially complete release of said coating from said member, and drying said coating on said paper, said release fluid being an organic liquid adapted to wet the surface of said smoothing member and having a freezing point substantially lower than the temperature to which said smoothing member is reduced, a boiling point above room temperature but not substantially higher than the boiling point of water and a substantially low and fluid viscosity at said reduced temperature of said smoothing member.

5. A process according to claim 4 in which said release fluid comprises a glycol.

6. A process according to claim 4 in which said release fluid comprises an ethylene glycol.

7. A process according to claim 4 in which said release fluid is a liquid comprising a mixture of glycol and water.

8. A process according to claim 4 in which said release fluid is a liquid comprising an eutectic mixture of glycol and water.

9. A process according to claim 4 in which said release fluid comprises a mixture of glycol, water and alcohol.

10. A process according to claim 4 in which said release fluid comprises a mixture of about 60% glycol, 30% water, and 10% alcohol.

11. A process according to claim 4 in which said release fluid is applied to said smoothing member in a metered amount sufficient to prevent audible releasing of said coating from said member upon separation but insufficient to cause visible softening of said coating on said paper.

12. A process according to claim 4 in which said release fluid is applied to said smoothing member in a metered amount to give a thin film of less than approximately 0.05 mil thickness on the surface of said member.

13. In a process of making coated paper of the character described wherein an aqueous coating composition is applied to the surface of said paper and brought into contact with a smoothing member, the steps of metering and applying a metered amount of a water soluble release fluid to the surface of said smoothing member as a substantially continuous film thereover, maintaining said release fluid film on said surface during smoothing of said coating, refrigerating said smoothing member effecting freezing of at least the surface portions of said coating on said paper, said release fluid film inhibiting wetting of said smoothing member by said coating prior to said freezing thereof and having a freezing point substantially below the temperature of said refrigerated smoothing member and a substantially fluid viscosity at said temperature, correlating the contact time between said coating and said roll and the temperature thereof for avoiding adhesion of said coating to said member and substantial admixing of said fluid with said coating, and separating said frozen coating on said paper from said smoothing member, said release fluid film effecting substantially complete release of said coating from the surface of said smoothing member.

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