

May 12, 1970

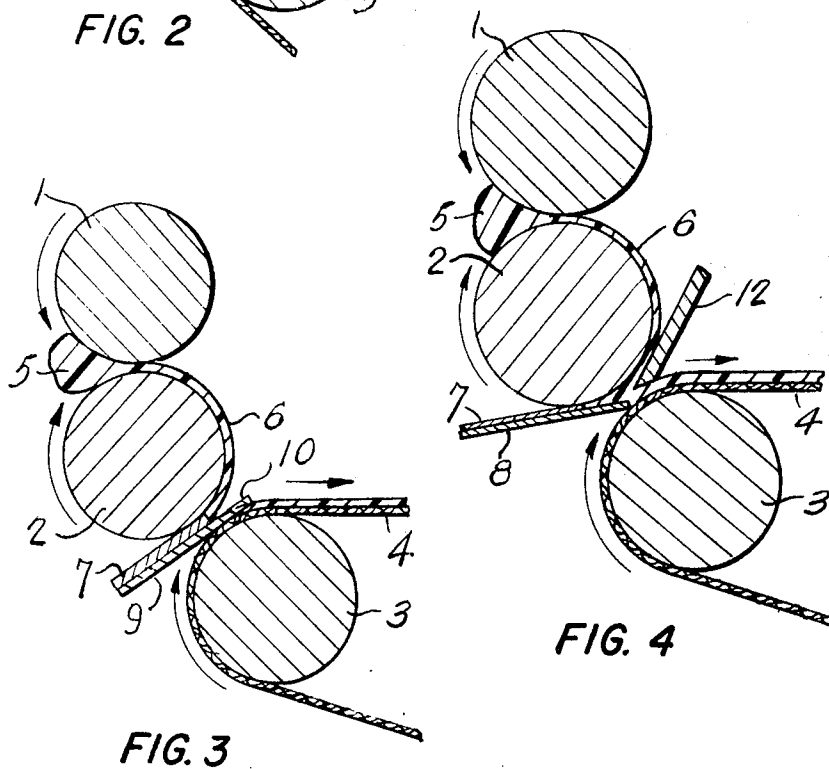
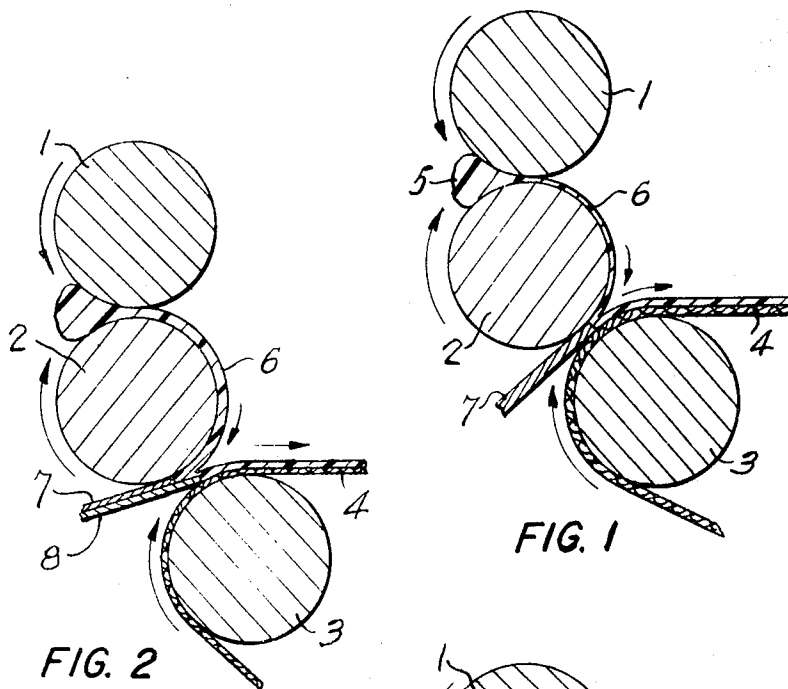
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3,511,696

REVERSE ROLL COATING PROCESS AND APPARATUS

Filed June 5, 1967

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

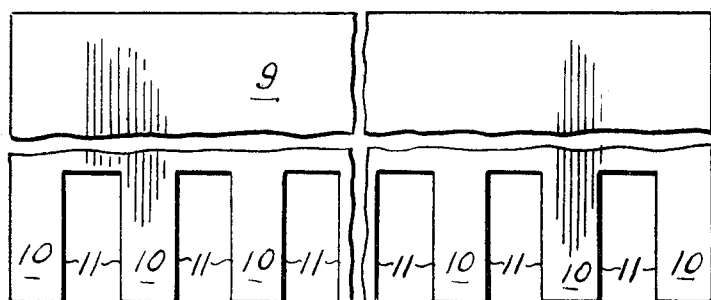


FIG. 5

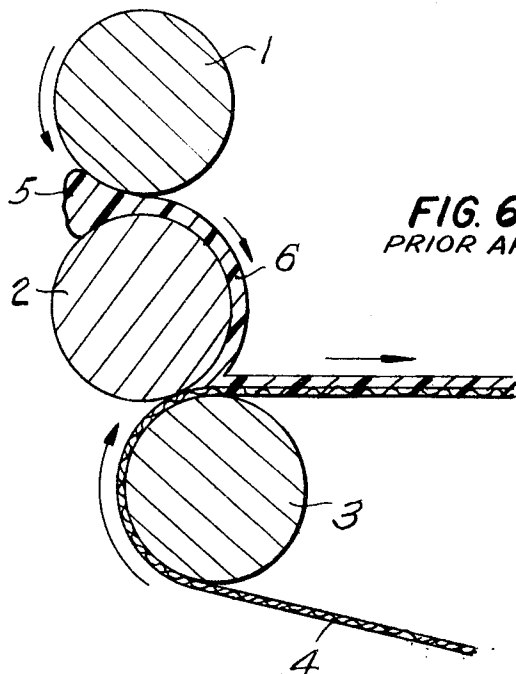


FIG. 6
PRIOR ART

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3,511,696 REVERSE ROLL COATING PROCESS AND APPARATUS

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Filed June 5, 1967, Ser. No. 643,711

Claims priority, application Canada, June 16, 1966,
963,156

Int. Cl. B05c 1/08

U.S. Cl. 117—111

6 Claims

ABSTRACT OF THE DISCLOSURE

A reverse roll coating apparatus for applying a coating to a travelling porous or open mesh type web with controlled penetration of said web by said coating. Contact between transfer roll and travelling web is prevented by means of a scraper blade or a combination of scraper blade and doctor blade.

This invention relates to web coating and, more particularly, to a process and apparatus for coating fabric web by the roll transfer method wherein there is less penetration of the web.

The use of roll coaters for direct coating of various types of webs is well known. However, among the numerous roll coaters heretofore used for coating webs, the most versatile and effective one is known as a "reverse roll coater." In essence, this coater comprises two oppositely rotating highly polished metal rolls, one being a metering roll which coating material is applied to and the other being a transfer roll bearing a layer or coating material of a thickness determined by the size of the gap between the said two rolls. In operation the web to be coated is continuously drawn along the surface of the transfer roll to pick up its layer of coating material by means of a resilient backing roll insuring contact of the web throughout its full width with the transfer roll.

Reverse roll coaters of the above character suffer from a serious disadvantage when used with certain types of webs and coating materials and this is known as "strike through." Indeed with these coaters the coating material is forced through the web and shows on the reverse side thereof, such undesirable results being aggravated when working with various porous webs such as loosely woven fabrics and with relatively thin and highly penetrative liquid coatings. For this reason, the use of reverse roll coaters has been restricted, in the past, to the coating of very closed weave fabrics or fabrics which had been given a previous coating of some sort to close up the weave.

It is a general object of this invention to provide a novel process and apparatus for web coating.

A more specific object of the invention is to provide a novel process and apparatus for applying a coating to a travelling porous or open mesh type web with controlled penetration of said web by said coating.

A still more specific object of the invention is to provide a reverse roll coater having a scraper blade or a combination of a scraper blade and doctor blade to prevent contact between the transfer roll and the web to be coated and to transfer pre-metered coating material from said transfer roll to said web.

These and other objects of the invention will become apparent to those skilled in the art upon consideration of the following description and accompanying drawings.

In said drawings:

FIG. 1 is a diagrammatic end view of a reverse roll coater incorporating a scraper blade according to the present invention;

FIG. 2 is a similar view of an embodiment of the invention wherein a doctor blade is combined with the scraper blade;

FIG. 3 is a similar view of a further embodiment of the invention wherein the doctor blade is a notched doctor blade;

FIG. 4 is a similar view of a still further embodiment of the invention incorporating a doctor knife;

FIG. 5 is a partly broken away plan view of the notched doctor blade incorporated in the embodiment of FIG. 3; and

FIG. 6 is a diagrammatic end view of a conventional reverse roll coater.

Referring to the drawings in which like reference numerals designate like parts, FIG. 6 will be described first, in order to illustrate the conventional reverse roll coating technique.

As shown in FIG. 6, coating material from a pool 5 thereof is metered by means of a metering roll 1 and a transfer roll 2 to a layer 6 of predetermined thickness. The transfer roll 2 carrying the coating layer 6 to be transferred to the web 4 travelling in the direction of the arrow, rotates in a direction opposite the moving direction of the contacting surface of the web, thus wiping all of the coating onto the web in the acute angle between the transfer roll 2 and web 4 which is driven and maintained in close contact with said transfer roll by means of a resilient backing roll 3.

As hereinbefore mentioned, this procedure suffers from the serious disadvantage of allowing the coating material to "strike through" the web, especially where the web is made of loosely woven fabric.

In accordance with the present invention penetration of the coating material through the web can be controlled by arranging a predetermined clearance gap between the transfer roll and the web and by effecting transfer of the coating layer from the transfer roll to the web by means of a scraper blade inserted into said gap in a direction opposite the direction of travel of the periphery of the transfer roll.

In FIG. 1 which illustrates one embodiment of the apparatus according to the invention, there are shown all the elements of the conventional reverse roll coater as hereinbefore described, said elements each effecting the same conventional function. Whereas, however, in said conventional coater, the transfer roll 2 and backing roll 3 are so arranged that at all times, part of the travelling web 4 is brought in contact with the transfer roll, in the coater of FIG. 1 a gap of a definite size is provided between said transfer roll 2 and web 4 into which is inserted a scraper blade 7 in a direction opposite that of the moving coating layer 6 on the transfer roll.

In order to control effectively the penetration of the coating material into the web, the gap must be adjusted so as to equal the desired coating thickness on the web plus the thickness of the layer on the transfer roll minus the desired degree of penetration of the coating material into the web.

The scraper blade which is of standard construction, may be of such a thickness as to fill the gap or may be thinner.

In practice, the scraper blade scrapes the pre-metered amount of coating material from the transfer roll, thus forming a bank of coating material which is then carried away on the web surface. The initial degree of penetration of the coating material into the web is controlled by the predetermined size of the gap between the transfer roll and the web while the final degree of penetration is a

function of the viscosity of the coating material which has been applied to the web.

In another embodiment of the invention as shown in FIG. 2, the scraper blade 7 is combined with a doctor blade 8. The two blades are arranged in contiguous relation and so disposed that the working edge of the doctor blade projects further in the gap than that of the scraper blade. This arrangement is to prevent contact of the scraper blade with the web and to avoid streaks on the coated product caused by web fluff being trapped on the scraper blade.

Where it is desired to obtain a lined coating on the web, use is made, instead of the standard doctor blade of FIG. 2, of a notched doctor blade the construction of which is illustrated in FIG. 5. As shown in said FIG. 5, the working end of the notched doctor blade is characterized by having teeth 10 alternating with indentations 11. In this embodiment of the invention, the structure of which is shown in FIG. 3, the notched blade 9 is arranged in contiguous relation with the scraper blade 7 and so positioned that the bottom of the indentations substantially coincides with the working edge of the scraper blade. The teeth 10 must be long enough to project out of the coating material so that, in operation, the scraped coating material is forced by virtue of the movement of the transfer roll 3 and web 4 through the indentations between the teeth 10 and thereby extruded on the web in the form of strips or lines.

FIG. 4 illustrates another modification of the apparatus shown in FIG. 2 and shows an embodiment of the invention in which a doctor knife 12 is so positioned in relation with the doctor blade 8 as to provide a slit through which the coating material is extruded on the web. As can be seen in FIG. 4, the doctor knife 12 is disposed in such a way that its working edge is substantially parallel to and faces the working edge of the doctor blade 8. By adjustment of the distance between the two opposing edges, a gap or slit of definite dimensions is formed through which the coating material from the bank created by the action of the scraper blade 7 is extruded on the web 4 in a layer of a definite thickness.

Although, throughout the drawings, the metering of the coating layer subsequently carried by the transfer roll is effected by means of a roll (metering roll 1), it should be obvious to those skilled in the art that other means could be used for that purpose such as, for instance, a doctor blade.

The transfer roll 2, backing roll 3, scraper blade 7, doctor blade 8 and doctor knife 12 are all of standard construction and are made of suitable material well known to those versed in the art of coating. The transfer roll may conveniently have a polished metal surface while the backing roll may generally be a rubber roll or a roll the surface of which consists of a resilient natural or synthetic resin. The blades and doctor knife are generally made of metal.

Although it has previously been specified that the process and apparatus of the invention are especially useful for coating porous or open mesh type web such as loosely woven fabrics, it is to be understood that it is also applicable to coating non-porous webs or strips of all kinds.

It has been found, for instance, that the process and apparatus of the invention are particularly effective in eliminating pinholing in the paste film when coating uneven surfaces such as embossed release paper.

The nature of the coating material that can be applied according to the technique of the present invention is not critical except that it must be such as to enable the material to be formed into a paste or plastisol suitable for application as a coating. It has been found, for instance, that the invention is of special advantage in the application of coatings of vinyl chloride resins.

A more complete understanding of the invention will be obtained from the following examples in which the percentages given are by weight unless otherwise specified.

EXAMPLE 1

A plastisol containing 45% of vinyl chloride, 45% of plasticiser and 10% of filler was prepared in a conventional manner. The paste viscosity using a Brookfield viscometer at 2 r.p.m. was 150,000 centipoise. At a shear rate of 9500 sec.⁻¹, viscosity was 2500 centipoise. The coating apparatus used was that shown in FIG. 2 and the web to be coated was a fabric.

Cast paste thickness=0.022"

Web paste thickness=0.025"

Metering gap=0.016"

Transfer:rubber roll ratio=2:1

Transfer:rubber roll nip gap=0.065"

Scraper blade thickness=0.050"

Doctor blade thickness=0.012"

Distance from edge of scraper blade to doctor blade=1/4"

Under these conditions a smooth uniform coating was cast onto the fabric at 15 y.p.m. with a fabric penetration of approximately 0.005".

A control operation was performed under identical conditions by removing the scraper and wiping the paste onto the fabric in the conventional manner. The paste completely penetrated the fabric wetting the non-coated side.

EXAMPLE 2

A plastisol containing 50% of vinyl chloride, 40% of plasticiser and 10% of pigment and filler was prepared in a conventional manner. Paste viscosity was 9000 centipoise at a shear rate of 1120 sec.⁻¹. The coating head was set up as illustrated in FIG. 1 and the web to be coated was embossed release paper.

Cast paste thickness=0.009"

Web paste thickness=0.007"

Metering gap=0.005"

Transfer:rubber roll speed ratio=2.8:1

Transfer:rubber roll nip gap=0.012"

Scraper blade thickness=0.012"

The paste was cast on the embossed released paper at a web speed of 14 y.p.m. producing a smooth film free from pinholes.

A control operation was performed using the same conditions but removing the scraper blade from the nip and closing the nip gap 0.002". The coating so produced was liberally peppered with pinholes.

EXAMPLE 3

A plastisol containing 55% of vinyl chloride resin, 35% of plasticiser and 10% of filler and pigment was prepared in a conventional manner. Paste viscosity was 100,000 centipoise with a Brookfield viscometer reading of 2 r.p.m. Paste viscosity at a shear rate of 1120 sec.⁻¹ was 12000 centipoise. The machine was set up as shown in FIG. 3 and a notched blade was used having a construction as shown in FIG. 5. The web to be coated was a cloth fabric.

Cast paste coating weight=6 1/2 oz./sq. yd.

Web thickness=0.025"

Metering gap=0.006"

Transfer:rubber roll speed ratio=2:1

Transfer:rubber roll nip gap=0.065"

Scraper blade thickness=0.050"

Notched doctor blade thickness=0.012"

The paste was cast onto the cloth fabric at a speed of 16 y.p.m. The paste coating was cast in smooth regular lines between which were lines of uncoated fabric. The particular notched blade used in this example had teeth 0.040 inch wide alternating with indentations of the same width.

What is claimed is:

1. An apparatus for continuously coating a web and for controlling the degree of penetration of coating material into said web, comprising in combination a continuously driven transfer roll, means to provide said roll

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with a uniform layer of said coating material at a predetermined thickness, a backing roll to support and drive said web to be coated and bring the surface thereof to a predetermined distance from the surface of said transfer roll, said distance forming a gap between the surfaces of said web and transfer roll which, when measured on a straight line drawn between the axes of said transfer and backing rolls, substantially equals the thickness of the layer of said coating material on said transfer roll plus the desired thickness of the coating on said web minus the desired degree of penetration of said coating material into said web, and a scraper blade inserted into said gap, the working edge thereof operating against the direction of the travelling coating layer on said transfer roll.

2. An apparatus as claimed in claim 1 wherein the thickness of the scraper blade is equal to the size of the gap.

3. An apparatus as claimed in claim 1, wherein the scraper blade is combined with a doctor blade the edge of which penetrates further in the gap than the edge of the scraper blade whereby the edge of the scraper blade is prevented from contacting the surface of the web.

4. An apparatus as claimed in claim 3 wherein the doctor blade has its working end formed with alternating teeth and indentation, the bottom of said indentation working in conjunction with the working edge of the scraper blade and the teeth being long enough to project out of the pool of scraped coating material at the nip between the web and the transfer roll.

5. An apparatus as claimed in claim 3 including a doctor knife the working edge of which is substantially parallel to and faces the working edge of the doctor blade, said edges being adjustable to a predetermined distance from each other and forming a slit through which the coating material is extruded on the web from the pool of

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said coating material created by the action of the scraper blade.

6. A process for continuously coating a web and controlling the degree of penetration of coating material into said web, which comprises supplying said coating material in a uniform layer of predetermined thickness to a continuously driven transfer roll, continuously drawing a web to be coated in a direction opposite the rotating direction of said transfer roll and passing it at a predetermined distance from said transfer roll, said distance forming a uniform gap between said web and transfer roll and being substantially equal to the thickness of the layer of coating material on said transfer roll plus the desired thickness of said coating material on said web minus the desired degree of penetration of said coating material into said web, scraping said coating material from said transfer roll at a point within the gap, thereby forming within said gap a bank of coating material from which said coating material is deposited on the web in uniform thickness by virtue of the continuous movement of the web.

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U.S. Cl. X.R.

118-244, 261