United States Patent [19]

Herzog

[11] **3,762,365**

[45] **Oct. 2, 1973**

[54] **WEB COATING APPARATUS**

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[73] Assignee: **Polytype AG,** Fribourg, Switzerland

[22] Filed: **Feb. 24, 1972**

[21] Appl. No.: **229,003**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 291, Jan. 2, 1970, abandoned.

[52] **U.S. Cl.** **118/212,** 118/249, 118/259, 118/261

[51] **Int. Cl.** **B05c 1/04**

[58] **Field of Search** 118/100, 407, 102, 118/409, 413, 414, 259, 258, 261, 249, 212; 101/350

[56] **References Cited**

UNITED STATES PATENTS

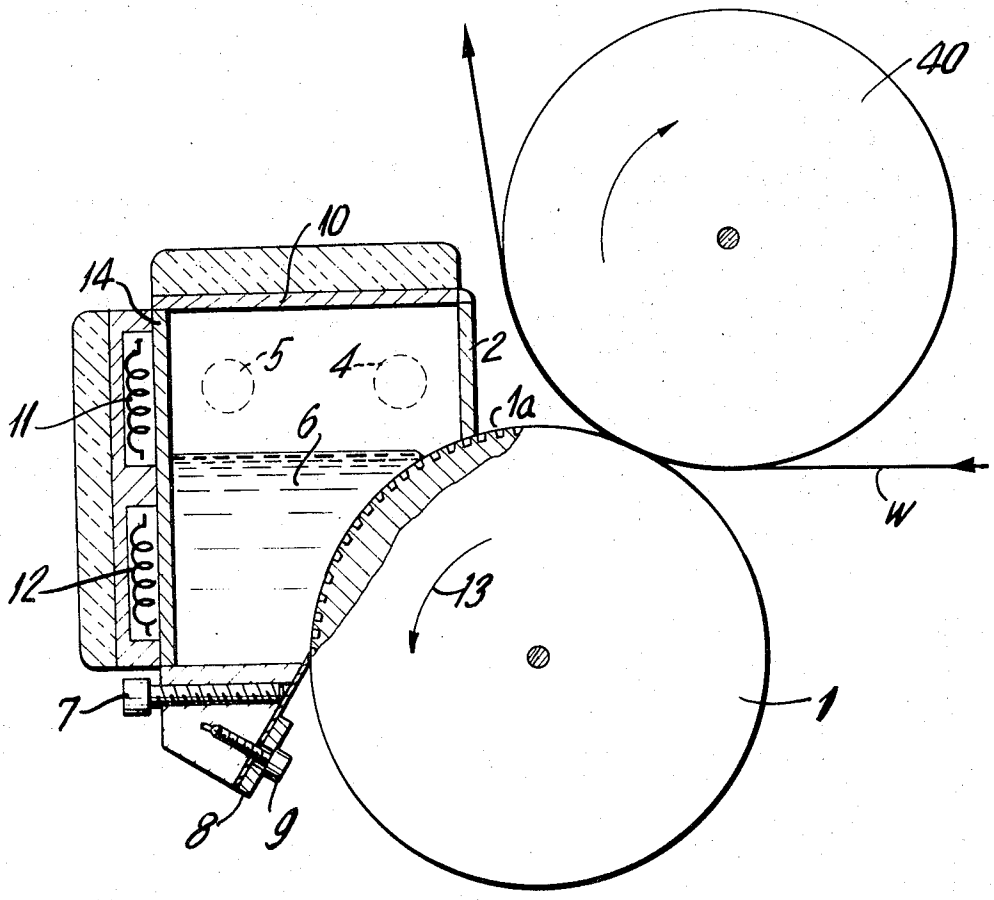
2,940,868	6/1960	Patchell	118/249 X
3,453,138	7/1969	Chen et al.	118/259 X
3,066,047	11/1962	Mahoney	118/413 X
1,235,326	7/1917	Kinsley	118/261 X
1,663,232	3/1928	Ambler	118/261 X
2,170,560	8/1939	Hayes	118/261 X
3,169,082	2/1965	Krikorian	118/413
3,511,693	5/1970	Davidson	118/413 X

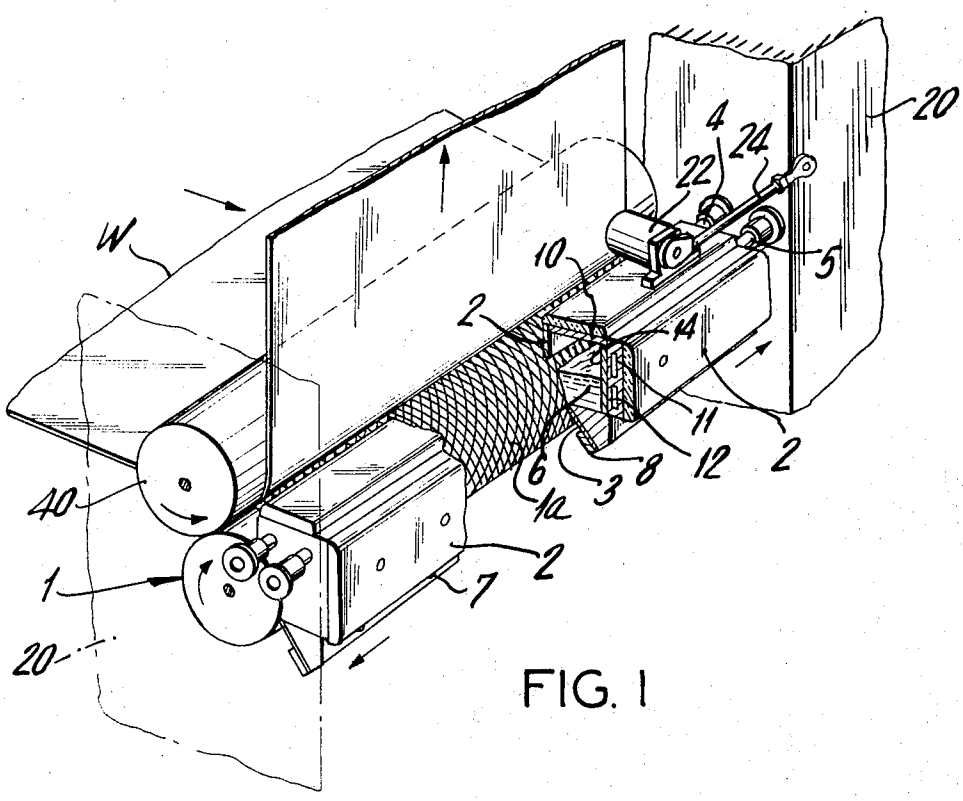
Primary Examiner—John P. McIntosh
Attorney—David Toren et al.

[57] **ABSTRACT**

An apparatus for coating paper, tissue, cardboard, metal foils, thermoplastic films and similar materials includes a hard surfaced raster roll having regularly formed depressions or cells inset into its circumferential surface and over which surface the material to be coated is directed. A portion of the circumferential periphery of the raster roll rotates through an opening in a tank containing a liquid melt of the substance to be coated. The raster roll picks up the liquid melt as its circumferential peripheral surface rotates through the tank and a wiper blade is positioned at the location at which the roll exits from the tank for removing any excess of the liquid melt and retaining it within the tank. The blade has its edge,which contacts the roll,extending toward the roll in the direction opposite to the direction in which the roll rotates. Further, the tank and the wiper blade are mounted for oscillatory or reciprocatory movement relative to the raster roll.

4 Claims, 5 Drawing Figures




W
10
2
4
22
24
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14
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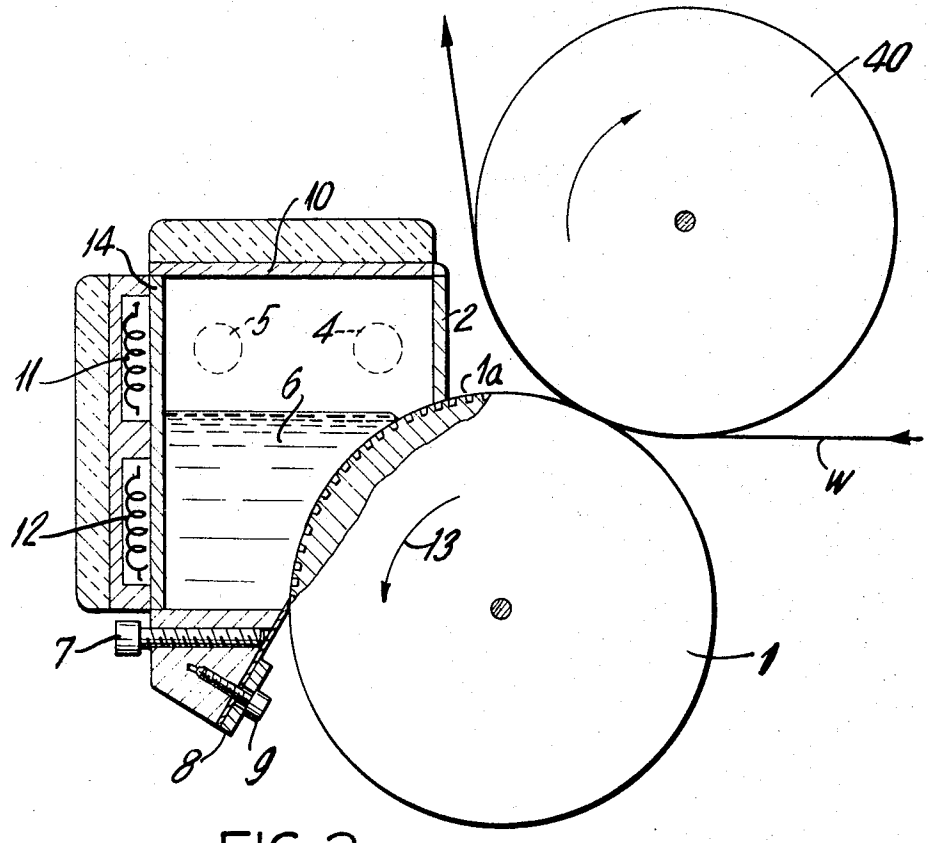
6
1a
3
8
40
1
7
20

FIG. 1


40
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1a
W
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FIG. 2

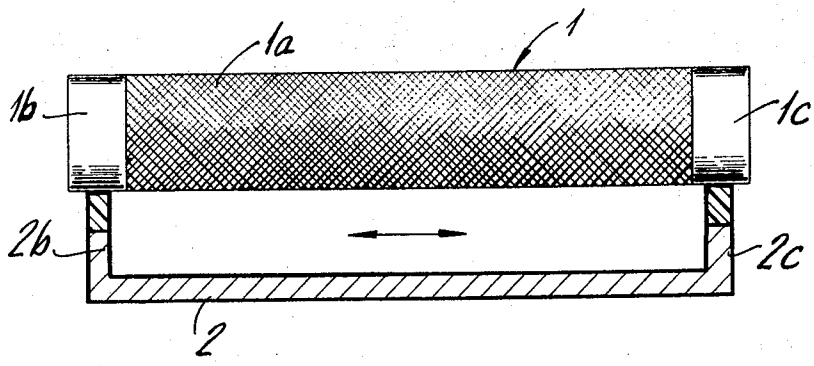

FIG. 3

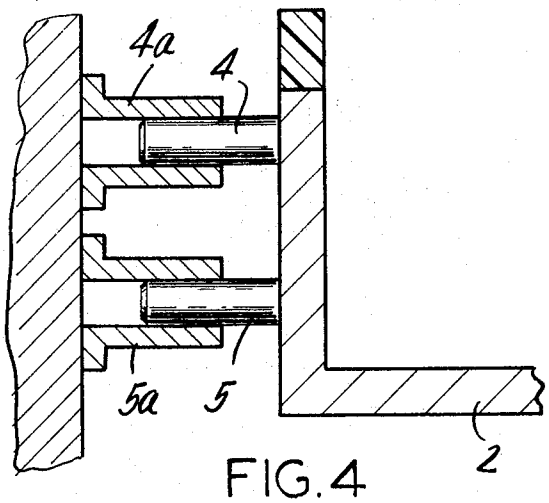

FIG. 4

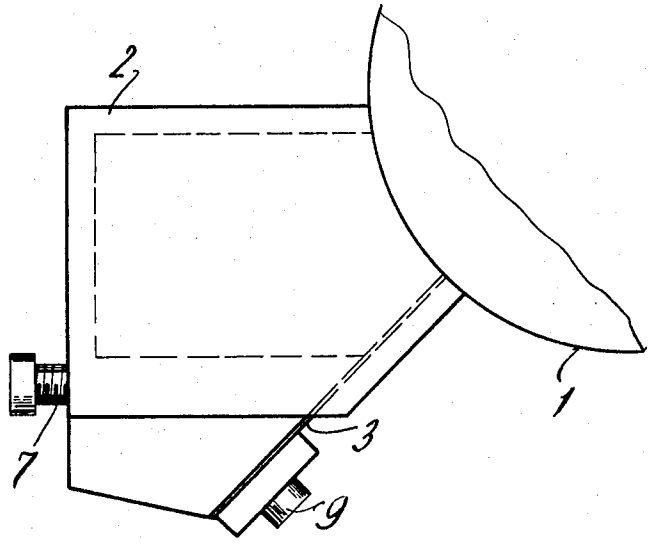

FIG. 5

WEB COATING APPARATUS

This is a continuation-in-part application of Ser. No. 291, filed January 2, 1970, now abandoned.

SUMMARY OF THE INVENTION

This invention relates in general to apparatus for coating webs and, in particular, to a new and useful apparatus for coating material such as paper, tissue, cardboard, thermoplastic film, metal foils such as aluminum and similar material with a highly viscous substance which is applied directly to the web by moving the web over the arcuate surface of a roller which has passed through a reservoir of the coating substance.

According to a known method, the coating of webs is effected by means of a pouring funnel having a nozzle discharge of slot shaped configuration through which the molten coating material issues as a curtain either by its own weight or under pressure. The issuing film is applied on the web which moves under the nozzle. The slot width of the nozzle generally determines the dosage in combination with the applying pressure and the velocity of the feed of the web. The slightest variation of any one of these factors will cause a considerable difference in the amount or weight of material which is deposited on the web. The excess material is usually collected in a tank and then pumped back into the pouring funnel. The air inclusions formed in the highly viscous melt material thus is contained in the coating film and accordingly, requires long conditioning zones in order to ensure that the air is removed and does not form bubbles. A further disadvantage of the known process is the requirement for high web tensions which are not suitable, for example, for coating very thin webs such as aluminum or other metal foil. In addition, with the known method, it is not possible to vary the coating process, for example, to vary the weight of one of the constituents or to vary the quality of the coating, such as its gloss. With the known method, generally, it is possible only to process melts of low viscosity.

Another known arrangement for the coating of webs is effected by a tank having a slotted nozzle which is arranged under the web; and, as the web is moved over the nozzle, the melt is permitted to ooze up into the web material which is stretched over the nozzle lip. The removal of the excess material of the coating and the equalization of the coating surface is effected by steel scrapers arranged behind the nozzle. With this process there is also the likelihood that air will be included in the coating because the excess material is pumped back to the coating tank and transferred to the web by the nozzle. In this arrangement, it is possible to process relatively highly viscous melts, however, a high web tension is required to obtain even a minimum stripping effect at the nozzle lip. For this reason, the arrangement is not suitable for applying a coating on tension sensitive webs.

A further known coating arrangement relates to the coating of webs by means of oppositely moving, smooth, chromium plated heated steel rolls. The amount of coating is determined by the gap width between the rolls and the melt is fed from a tank located above the nip of the rolls. A disadvantage of this method is that it is difficult to provide the necessary circumferential velocities and rotating accuracies of the roll and the velocity of the web fed between them and to construct the arrangement so that there is no sagging between the roll which would vary the quantity of coating applied across the web material. Since the velocity differences of the circumferences of the rolls relative to the web to be coated are considerable, high residual pressures are formed in the roll gap when highly viscous melts are used. In addition, for a relatively small deposit of coating the rolls must be so closely spaced that they can be easily damaged. Some attempts have been made to coat web material by means of a raster roll over which the web material is fed. The raster roll draws the melt by its rotation adjacent the bottom of a tank supply thereof and it delivers the melt under an oscillating wiper. The wiper strips off the excess of the melt coating so that only the raster cups or recesses defined in the raster roll are filled. With highly viscous melts, however, the wiper is pushed away from the roll by the wedging effect of the melt and thus changes the weight of the coating being applied. In addition, the film breaks on the raster roll when using a high viscosity melt and operating at high speed of the raster roll so that the drawing effect is practically cancelled. As a result, the web is only partly coated. Another disadvantage is the requirement for the heating of the relatively large quantities of the melt material due to the fact that the melt is a very poor conductor and, therefore, large quantities of the melt material tend to have considerable local temperature variations. Such temperature variations also produce great variations in viscosity. For this reason it is very difficult, it not impossible, to provide a coating of a relatively low weight at high velocity operation.

In accordance with the present invention, the disadvantages of the prior art are avoided and an effective apparatus for coating with highly viscous substances is provided. The invention includes a rotatable raster roll which extends into a reservoir containing the melt material to be coated through an opening formed in the walls of the reservoir. As the surface of the roll emerges from the reservoir with the melt material it is engaged by a wiper blade which is arranged substantially contacting the surface of the roller and the edge of the wiper blade contacting the roller is directed opposite to the direction of rotation. The melt material is supplied into the tank from the top thereof and it is maintained in the melted condition by heaters carried by the tank. The tank is advantageously supported on guides for horizontal oscillating movement along an axis in parallel with the axis of rotation of the raster roll.

Accordingly, it is an object of the invention to provide an improved means for applying a coating to a web which includes a rotatable raster roll over which the web travels and with a portion of the roll's circumferential periphery extending through an opening in a reservoir containing the coating material. The coating material is maintained in a proper melted condition and is wiped from the surface of the raster roll by a wiper blade positioned extending toward the surface of the roll. The wiper blades contact the surface of the raster roll at its point of exit from the reservoir as it rotates.

A further object of the invention is to provide a coating device which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings

and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the apparatus embodying the present invention;

FIG. 2 is an enlarged transverse cross sectional view of the apparatus illustrated in FIG. 1;

FIG. 3 is a view, partly in section, of a portion of the apparatus shown in FIGS. 1 and 2;

FIG. 4 is an enlarged sectional view of a part of the apparatus shown in FIGS. 1 and 2; and

FIG. 5 is an end view of a portion of the apparatus shown in FIG. 1.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings the apparatus illustrated includes a rotatable raster roll **1** which is mounted for rotation in the direction of the arrow **13** about a horizontal axis. The raster roll is a steel roll with a thin layer of chromium, for example, about 80 microns thick, plated on its circumferential periphery for protection against corrosion and rapid wear. Except for the opposite end portions, the entire circumferential peripheral surface of the raster roll is worked to provide a uniform arrangement of depressions or cells **1***a*, note FIG. **3.** The depressions or cells can have a variety of shapes, such as inverted pyramids with quadrangular bases, inverted truncated pyramids with quadrangular bases and diagonal V-shaped grooves. The depressions or cells are formed in a raster roll by a "molette", that is a working or engraving roll. Extending horizontally along one side of the raster roll is a tank **2** containing a quantity of a substance **6,** such as wax or a hot melt substance, for coating paper, tissue, cardboard, thermoplastic film, metal foil such as aluminum, and similar materials. An opening **2***a* is formed in the side and bottom of the tank adjacent the raster roll and the roll is positioned relative to the tank so that it extends laterally through the opening into the body of the coating substance **6.** As the raster roll **1** rotates, its circumferential peripheral surface picks up the coating substance from within the tank **2** in the depressions or cells **1***a*.

As illustrated in FIG. **4,** horizontally arranged guide members **4** and **5** are secured to the ends of the tank **2** and extend into bushings **4***a* and **5***a*, respectively, mounted on a stationary frame **20.** In addition, a motor **22** with an eccentric cam, not shown, is mounted on the tank and a rod extends from the cam and is fixed to the frame **20.** As the motor **22** drives the cam, the rod which is fixed to the frame **20** imparts a reciprocating action to the tank so that is oscillates or reciprocates in the horizontal direction supported and guided by the sliding engagement of the guide members **4** and **5** within the bushings **4***a* and **5***a*. Accordingly, the tank moves in the horizontal direction with a reciprocating or oscillatory motion relative to the raster roll **1.**

As can be seen in FIG. **3,** the horizontal dimension of the raster roll **1** is greater than that of the tank **2** so that the ends **1***b* and **1***c* of the roll extend laterally beyond the upwardly extending ends **2***b*, **2***c* of the tank. The amount of reciprocating or oscillating movement of the tank is such that its ends **2***b*, **2***c* do not extend beyond the corresponding ends **1***b*, **1***c* of the roll and, accordingly, there is no leakage from the tank.

Previously it was mentioned that the opposite ends of the raster roll **1,** that is the ends **1***b* and **1***c*, do not contain the depressions or cells **1***a*, and this is evident from FIG. **3.** Further, the portions of the corresponding ends **2***b*, **2***c* of the tank **2** which define the opening **2***a*, each have a Teflon coating **30** for facilitating the relative sliding action between the tank and the raster roll and for preventing leakage from the tank.

On the opposite side of the tank **2** from its opening **2***a*, a side wall **14** has upper and lower heating elements **11** and **12** for maintaining the temperature of the coating substance **6** at a level sufficient to afford the desired coating action. The coating substance **6** is supplied into the tank **2** in a liquid or melted condition through an inlet, not shown. A cover **10** closes the tank **2** at its top and can be removed for inspection, maintenance and operational purposes.

As the raster roll **1** rotates through the opening **2***a* in the tank **2,** its depressions or cells **1***a* pick up the coating substance **6** and a doctor or wiper blade **3** is positioned at the exit side of the opening relative to the direction of movement of the roll for removing any excess of the coating substance from the surface of the roll and for retaining the excess within the tank. The wiper blade **3** is formed of steel sheet. The wiper blade is secured to and oscillates with the tank **2** by means of a tongue or plate **8** which is held in position on the tank by screws **9.** Further, one or more adjustment screws **7** are mounted in the lower end of the tank for providing fine adjustment of the wiper blade in respect to the circumferential peripheral surface of the raster roll **1.** As can be noted in FIGS. **1** and **2,** the edge of the wiper blade which removes the excess is directed against the raster roll so that it faces in the direction opposite to the direction of rotation of the roll.

To assure a uniform temperature level throughout the body of the coating substance **6** in the tank **2,** one or more immersion heaters, not shown, are positioned within the body of the coating substance.

In FIGS. **1** and **2** the operation of the apparatus is indicated with a web W of the material to be coated passing through the nip between the raster roll **1** and another roll **40** the direction of feed of the web and of rotation of the rolls is shown by arrows. As the raster roll rotates through the opening **2***a* in the tank **2,** it picks up the coating substance **6** in its cells **1**a and any excess on its surface is removed by the wiper blade as the roll exits from the opening at the lower end of the tank. As the roll rotates, the tank **2** and the wiper blade **3** oscillate or reciprocate in the horizontal direction relative to the roll in effecting the filling of the cells **1***a* and the wiping of excess coating substance from the surface of the roll.

As the raster roll rotates, its surface containing the cells in which the coating substance is located, comes into contact with the surface of the web W at the nip between the rolls and the coating substance is transferred to the web as required. As an example of a typical coating operation, a cellulose paper of 58 g/m_2 travelling at a speed of 300 m/minute is coated with 7 g/m_2 of Lunamelt HS 400 by the raster roll. Further, with this apparatus wax coatings of 100 g/m_2 can be applied to the material to be coated. The temperature of the coating substance in the melted condition depends on the type of substance being used and generally ranges between 60° and 190° C. As indicated above, the tank **2** is heated so that a uniform temperature is

maintained throughout the body of the coating substance.

By the combination of the wiping action provided by the wiper blade, which retains any excess of the coating substance from the surface of the raster roll within the tank, and the oscillating movement of the tank and the blade, the problem experienced in the prior art, where air bubbles included in the coating interfered with the proper coating action, is overcome.

The sealing action afforded between the edges of the tank and the corresponding ends of the raster roll against which the edges bear as they oscillate back and forth, assures that the operation can proceed without any problem of leakage of the coating substance from the tank.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. Web coating apparatus comprising a horizontally elongated tank containing a pool of fluid coating substance and said tank including a pair of laterally spaced tank ends with a bottom member, and a back member extending between said tank ends and defining an opening formed in said tank extending in the horizontal direction thereof and formed in the lower portion of said tank ends and in an adjacent part of the bottom member and the opening arranged in communication with the pool of coating substance in the tank, a raster roll of a length longer than said tank having depressions formed in at least a portion of its central circumferential periphery and mounted for rotation about a horizontal axis positioned adjacent said opening of said tank, said raster roll extending along said tank with a portion of its circumferential periphery projecting through the opening in said tank into the pool of fluid coating substance therein, said tank ends disposed transversely of the axis of said roll and the lower portions of said tank ends being curved to complement and in sealing engagement with the curved surface of said roll means for oscillating said tank in the horizontal direction relative to said roll, and an elongated wiper blade mounted on said adjacent part of the bottom member of said tank and extending obliquely of the bottom of said tank, the wiping edge of said blade located closely adjacent to and extending along the circumferential periphery of said roll at the point of emergence of the surface of said roll from contact with the pool of fluid coating substance for providing a wiping action on the circumferential periphery of said roll, said blade is positioned so that its wiping edge in contact with said roll faces toward said roll in the direction opposite to the rotation of said roll when the roll surface is moved downwardly past said bottom member, and means arranged for adjustably mounting said wiper blade on the bottom surface of said tank and for providing a fine adjustment of its wiping edge relative to the circumferential periphery of said roll.

2. Web coating apparatus, as set forth in claim 1, wherein the circumferential periphery of said raster roll having opposite end portions and a center portion extending between said end portions, the depressions formed in the circumferential periphery of said raster roll arranged in a uniformly spaced manner over the center portion of the circumferential periphery of said raster roll.

3. Web coating apparatus, as set forth in claim 1, wherein said means for oscillating said tank comprises a stationary frame, horizontally extending bushings fixed to said frame, horizontally extending guide members attached to said tank and slidably supported within said bushings, and means secured to said tank and fixed to said frame for oscillating said tank in the horizontal direction with said tank supported by said guide members sliding in said bushings.

4. Web coating apparatus, as set forth in claim 3, wherein said means secured to said tank and fixed to said frame includes a motor mounted on said tank, a rod secured to said motor and fixed to said stationary frame for effecting an oscillating movement as said motor is operated for transmitting the oscillating movement to said tank.

* * * * *

T871

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,762,365 Dated October 2, 1973

Inventor(s) Peter Herzog

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent, insert:

--[30] Foreign Application Priority Data

January 10, 1969 Sweden.....No. 314-69--

Signed and sealed this 1st day of January 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

FORM PO-1050 (10-69)

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☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.