

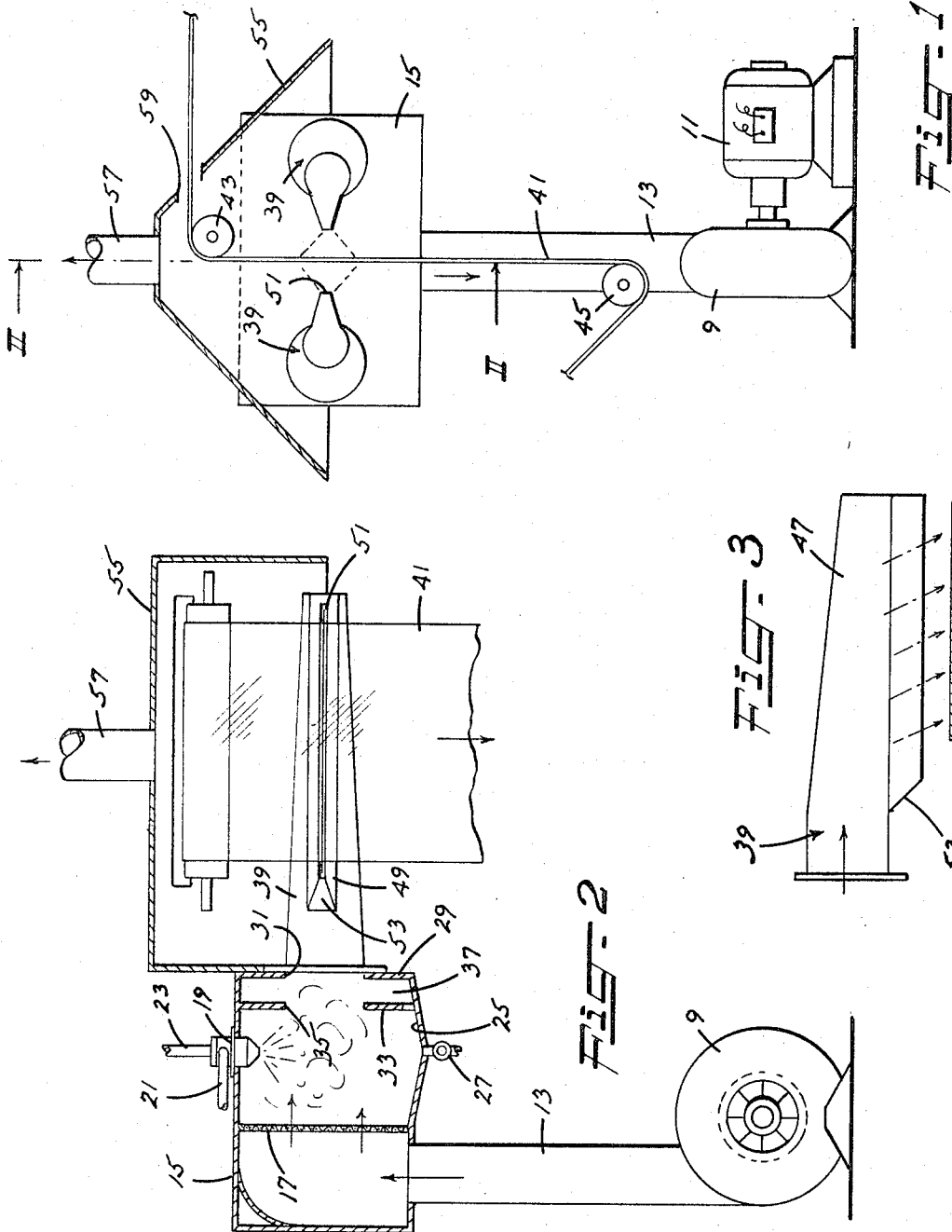
May 14, 1968

E. JESTER

3,382,845

SEPARATING LIQUID DROPLETS IN SPRAY COATING OPERATION

Filed July 21, 1964



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SEPARATING LIQUID DROPLETS IN SPRAY
COATING OPERATION

Edward Jester, Wilmington, Del., assignor to Avisun Corporation, Philadelphia, Pa., a corporation of Delaware

Filed July 21, 1964, Ser. No. 384,073

2 Claims. (Cl. 118—610)

ABSTRACT OF THE DISCLOSURE

A film or web is coated by mixing an atomized treating liquid with a stream of carrier gas (e.g., air) in a mixing chamber, the carrier gas then conveying the mist or fog through nozzles to the web. After the mixing, the mist-containing gas stream is allowed to expand, causing liquid droplets to separate out so that they do not reach the web. Prior to the mixing, the carrier gas is caused to have a non-turbulent flow pattern.

This invention relates to a method and apparatus for applying a thin coating onto a traveling film or web.

In the manufacture of films from organic materials, it is common practice to coat one or both sides of the film to impart a desirable characteristic to the film or to enhance some particular property which the film already exhibits. For example, it is often desirable to apply anti-static agents onto films formed of polyethylene or polypropylene or to coat such films with suitable thermoplastic compositions which will permit the film to be heat sealed at temperatures which are lower than the softening range of the particular base film.

In general, conventional coating methods and apparatus have been found to be unsatisfactory when employed with films in which the optical properties, such as film transparency and gloss, are important considerations. Particular disadvantages of such known coating methods and apparatus are that the applied coatings are non-uniform or spotty and often tend to run. In both instances the film appearance and optical properties suffer. Furthermore, it was found that when an extremely thin or fine coating was desired, such result was generally accompanied by a significant sacrifice in the uniformity of the applied coating. Accordingly, a primary object of this invention is to provide a generally new and improved and more satisfactory film coating method and apparatus.

Another object is to provide an improved method and apparatus which is especially adapted for applying a thin and uniform coating onto a traveling web.

Still another object is the provision of an improved method and apparatus in which an extremely fine and substantially uniform mist, fog or dust of coating material is sprayed onto a traveling film or web.

Still further objects will appear from the following description.

These objects are accomplished in accordance with the present invention by a method and apparatus in which a treating liquid, such as a solvent or aqueous type coating composition, or a powder is sprayed into a moving stream of air or other gas whereby the treating material is carried in the form of a fine mist, fog or dust and subsequently applied onto one or both sides of a traveling film or web. More particularly, the apparatus of the present invention includes a mixing chamber wherein a treating liquid is atomized and dispersed within a moving stream of air or other gas. A screen is provided for distributing and removing or minimizing turbulence and/or pressure differentials in the carrier air or other gas as it enters the mixing chamber, and at least one nozzle is connected to the

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chamber for directing the gas carried mist or dust of treating material toward or against a surface of a traveling film or web. The nozzle extends transversely across the path of the web which is to be treated and is formed with a continuous discharge slot from which the gas carried mist issues at substantially an optimum included angle of about 65° relative to the web surface. The gas carried mist or dust is introduced into one end of the nozzle and the nozzle itself is of tapered construction so that the gas issues therefrom under substantially the same pressure and exit velocity along the entire length of the nozzle discharge slot.

Preferably, the mixing chamber is provided with an expansion chamber adjacent to its outlet for removing any droplets of treating liquid from the carrier gas before it enters into the nozzle. Generally, such droplets may result when excess treating liquid is dispersed within the mixing chamber and condenses on the inside surfaces of such chamber. In the absence of the expansion chamber, such droplets of treating liquid are often picked-up by the carrier gas and, when applied, provide for a spotty coating on the web.

An exhaust hood is preferably positioned in the vicinity of the delivery nozzle so as to continuously remove the spent gas.

In the drawing,

FIGURE 1 is an end view of the apparatus of the present invention as employed in treating the opposite sides of a traveling web;

FIGURE 2 is a front view of the apparatus shown in FIGURE 1 looking in the direction II—II; and

FIGURE 3 is a detailed view illustrating a nozzle which forms a part of the apparatus of the present invention.

Referring now to the drawing, the apparatus of the present invention includes a blower 9 which is driven by a motor 11 for delivering a desired volume of gas, such as air, through a conduit 13 and into a mixing chamber 15. A screen 17 extends across the mixing chamber 15 to distribute the air along the entire chamber cross section, to remove or minimize turbulence and to blend together the portions thereof which are under different pressures. At least one atomizer 19 projects into the mixing chamber 15 and is connected by pipes 21 and 23 to a suitable source of air and a treating liquid, such as a film anti-static agent. The atomizer 19 breaks up a continuous stream of the treating liquid and disperses the same as a very fine mist or fog within the moving stream of air.

Under certain conditions, and particularly when excess treating liquid is delivered into the mixing chamber, the treating liquid condenses upon the inside surfaces of the mixing chamber and collects as droplets. Normally, such droplets settle and collect along the dished bottom wall 25 of the chamber 15 from which they can be removed by a drain 27. Often, however, the droplets of treating liquid which form on the chamber wall 29 are swept through the outlet opening 31 by the carrier gas and, when subsequently applied, provide for a spotty and unattractive coating.

This objection is avoided in the apparatus of the present invention by positioning a baffle or partition 33 within the mixing chamber 15 substantially parallel to its wall 29. This baffle 33 is formed with an opening 35 which is aligned with and of substantially the same size as the outlet 31 opening and cooperates with the wall 29 to form an expansion chamber 37. With this arrangement, as the mist-containing air stream flows past the baffle 33 and expands, any large droplets of liquid which it may contain are deposited within the expansion chamber 37.

From the mixing chamber 15 the suspended particles of treating liquid are carried by the moving air stream into nozzles 39 which are located along the opposite sides

of a web 41 as it travels between rollers 43 and 45. The nozzles 39 are of like construction and include a main housing 47, which is connected at one end to the mixing chamber 15, and a projecting lip portion 49 having a continuous, elongated discharge slot 51. As shown in FIGURE 3, the end wall 53 of the nozzle lip portion 49 is inclined so as to direct the liquid containing air stream from the discharge slot 51 at an optimum angle of about 65° relative to the web surface. Additionally, it will be noted that the nozzles 39 are each of tapered construction or of gradually reduced cross section to ensure that the liquid-air mixture is discharged under substantially the same pressure and velocity along the entire length of the discharge slot 51.

Preferably a hood 55 is positioned above the web treating zone and includes an exhaust conduit 57 which is connected with a suitable blower, not shown, for removing the spent air.

In operation the web 41 which is to be treated, as for example a polypropylene film, is passed through an opening 59 in the hood 55 and is then laced over the rollers 43 and 45. The blower 9 is then set in operation so as to deliver a desired volume of air through the conduit 13 to the mixing chamber 15. This air is distributed and given a generally straight, uniform and non-turbulent flow as it passes through the screen 17 and is then mixed with a very fine mist or fog of treating liquid which is provided by the atomizer 19. The liquid containing air is then delivered to the nozzles 39 from which it is discharged at a desired angle of about 65° relative to the web surface, as indicated in FIGURE 3. As heretofore mentioned, the spent air is removed from the treating zone by the exhaust hood 55 and conduit 57.

By atomizing the treating liquid into a very fine mist or fog by the atomizer 19, the treating liquid is easily maintained in a suspended condition as it is conveyed by the moving stream of air. As this air carried mist issues from the nozzle, it has the appearance much like that of smoke and can be applied as a very thin and uniform layer onto one or both sides of the web 41. Any large droplets of liquid which are captured by the air stream within the chamber 15 are deposited within the expansion chamber 37. Further, there is little tendency for the extremely fine particles of treating liquid to agglomerate while they are suspended within the moving air stream and thus the deposition of large droplets of treating liquid, which might detract from the physical and/or optical properties of the web, is avoided or at least minimized. In view of the extremely fine particles of treating liquid which are applied and the presence of the

carrier air, generally no drying of the coated web is required. Microscopic examination of the coated web has established that the applied particles of treating material are of extremely fine size and that such particles are substantially uniformly spaced from each other along all portions of the web.

It will be noted that by changing the volume and/or speed of the air moving past the atomizer 19, the amount of treating liquid dispersed within the air carrier can be varied so that the thickness or amount of treating liquid deposited can be readily controlled.

While the above detailed description of the invention has been directed to coating of a web with an air carried liquid mist, it will be understood that the method and apparatus are equally well adapted for dispersing, suspending and applying powders or dusts.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Apparatus for applying a thin layer of treating liquid onto a web including means for supporting and moving a web to be treated, a mixing chamber, means for moving a gas into and through said mixing chamber, a screen positioned along the entrance to said mixing chamber for imparting a straight, uniform and generally non-turbulent flow to the moving stream of gas as it enters therein, an atomizer for dispersing a treating material as very fine particles within the gas stream as it moves through the mixing chamber, and a nozzle for directing the particle-containing gas against said web.

2. Apparatus as defined in claim 1, including also an expansion chamber, adjacent the outlet from said mixing chamber and located between two relatively restricted openings through which the particle-containing gas passes prior to its entry into said nozzle, said expansion chamber operating to remove large particles of treating material from the particle-containing gas before it enters said nozzle.

References Cited

UNITED STATES PATENTS

1,547,513	7/1925	Morden	117—104
2,028,796	1/1936	Merritt	117—106
2,035,677	3/1936	Steinke.	
2,155,932	4/1939	Davis.	

RALPH S. KENDALL, *Primary Examiner.*

ALFRED L. LEAVITT, *Examiner.*

A. GOLIAN, *Assistant Examiner.*