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MIST CONTROL ON AIR KNIFE COATERS

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Fig. 1

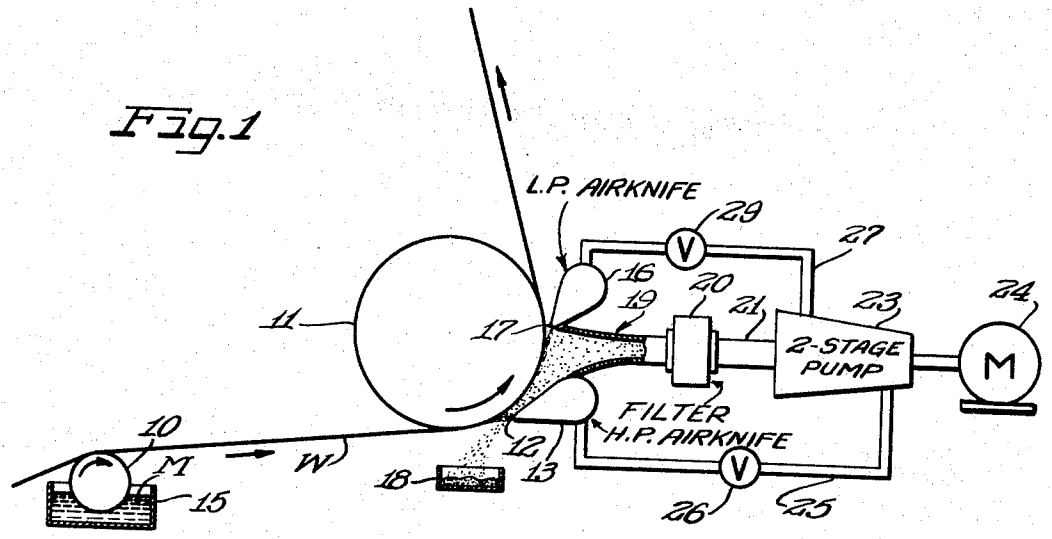


Fig. 2

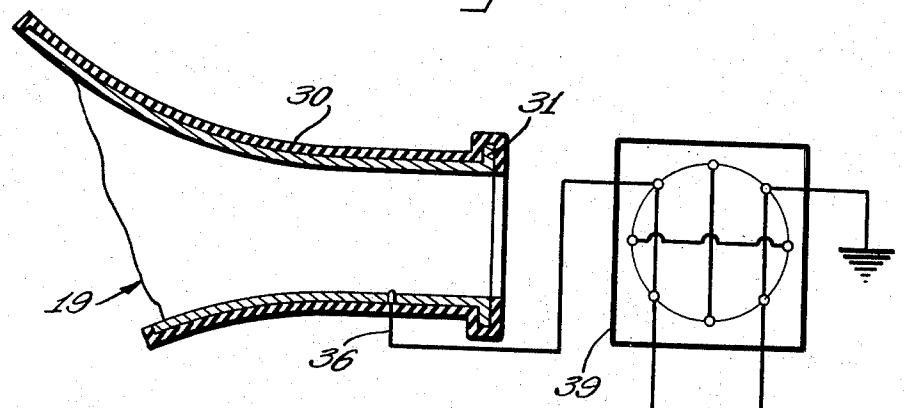
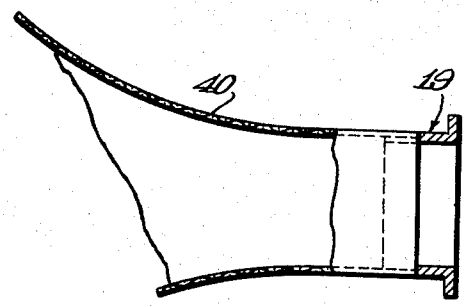


Fig. 3



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MIST CONTROL ON AIR KNIFE COATERS

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This invention relates to improvements in paper coating machines and more particularly relates to an improved apparatus for collecting and controlling the fine particle mist that forms on the outgoing side of a coating smoothing air knife.

In coating machines in which a continuously travelling web is trained partially about a backing roll and in which coating is applied thereto by an applicator roll spaced from the backing roll, an air knife has frequently been used to control the quantity of coating material and to increase the smoothness of the material.

The air knife usually directs an air jet from a slot across the coated surface of the web with the resultant formation of a fine particle mist immediately adjacent the air knife and on the outgoing side thereof.

The instant invention is particularly intended to avoid marking of the paper web caused by the fine particle mist by providing a second low pressure air knife on the outgoing side of the first air knife and confining the fine particle mist between the two air knives for collection by suction.

Another object of the invention is to provide an improved method and apparatus for smoothing the coacting material on a web on the air knife principle and removing the fine particle mist in the region of the air knife and thereby preventing the fine particle mist from becoming redeposited on the freshly coated web.

A further object of the invention is to provide an improved form of coater for paper webs, in which the coating material is smoothed by an air knife, by providing a second air knife on the outgoing side of the smoothing air knife and providing a suction chamber between the two air knives and removing the fine particle mist therebetween by suction.

Still another object of the invention is to improve upon the coaters heretofore in use for coating travelling paper webs and utilizing an air knife to control the quantity of coating material and to smooth the coating material, by providing a second low pressure air knife, with a suction chamber between the air knives, collecting the fine particle mist delivered thereto by the second air knife and by drawing the particle mist away from the air knives and collecting the particle mist electrostatically.

A further object of the invention is to improve upon the coaters heretofore in use utilizing an air knife to control the quantity of coating material on a web and to smooth the coating material by providing a two stage pump, the high pressure range of which has connection with the air knife, and by utilizing the low pressure stage of the pump to supply low pressure air to a second air knife spaced circumferentially from the first air knife to confine the fine particle mist and to utilize the suction developed at the intake of the pump to carry away the fine particle mist in the space between the air knives.

A still further object of the invention is to prevent the accumulation of fine particle mist in the surrounding

atmosphere of an air knife coater and prevent streaking of the web by the redepositing of the fine particle mist thereon, by the use of two circumferentially spaced air knives, a first air knife being a high pressure air knife and the second air knife being a low pressure air knife and positioned on the outgoing side of the first air knife, and by providing a suction chamber between the air knives, collecting the fine particle mist in the space therebetween, in which a single two stage pump serve to supply high pressure to the first air knife and low pressure to the second air knife on the outgoing side of the first air knife, and serves to provide the vacuum for the suction chamber, and in which a filter is provided upstream of the pump intake and the filter intake is made of a foraminous material accommodating fresh makeup air to be drawn intto the pump, tto thereby avoid disturbances at the air knives.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a diagrammatic view in side elevation of a coater constructed in accordance with the principles of the present invention, with certain parts in vertical section;

FIGURE 2 is a diagrammatic sectional view of the suction chamber and intake to the filter showing the intake electrostatically charged; and

FIGURE 3 is a diagrammatic view illustrating a foraminous suction chamber forming an intake to the filter and pump.

In the embodiment of the invention illustrated in FIGURE 1 of the drawings, I have diagrammatically shown an air knife coating apparatus in which a paper web W passes over a coating applicator roll **10**, and is partially wrapped about a backing roll **11** on the outgoing side of the applicator roll anl spaced therefrom. The applicator roll **10** is partially immersed in a coating bath M contained in a coating pan **15**. The coated surface of the roll passes to the outside of the backing roll **11** and is subjected to the impingement of air thereon through an elongated nozzle **12** of a high pressure air knife **13**. The air knife **13** extends across the web W and the elongated nozzle **12** extends for the width of the web W to provide an air blade directed longitudinally of the backing roll in a direction opposite to the direction of travel of the web to remove excess coating material from the web. A trough **18** is spaced in coating material receiving relation with respect to the air nozzle **12**, and extends for at least the width of the backing roll **11**, to collect the coating material removed by said air knife.

On the outgoing side of the air knife **13** is a low pressure air knife **16** having an elongated nozzle **17** extending for the width of the web, and impinging air on the web W, tangentially thereof at a lower pressure than the pressure of air impinged on the web by the air knife **13**, and serving to retain the fine particle mist to a suction chamber **19**, between the air knives **13** and **16**, and extending for the full width of the web or backing roll **11**.

The suction chamber **19** has communication at its discharge end with a filter **20**, connected with an intake pipe **21**, forming the intake for a two stage pump **23**. The pump **23** may be of a conventional form and is shown as being driven from a motor **24** directly con-

nected therewith, although the drive connection need not be a direct drive connection, but may be a belt or geared drive connection, or any suitable conventional drive connection.

The intake or suction of the two stage pump **23** will thus create a vacuum in the suction chamber **19** and withdraw the fine particle mist from the offgoing side of the high pressure air knife **13** through the filter **20**, which will filter the particle mist prior to entering the pump.

The air knife **13** is provided with air at a relatively high pressure by means of a conduit **25** connected with the high pressure stage of the pump **23**. A valve **26** of a conventional form is provided in said conduit.

The low pressure air knife **16** is supplied with air, through a conduit **27**, having a shut-off valve **29** therein and connecting the low pressure stage of the two stage pump **23** with said low pressure air knife, to supply air to the nozzle **17** at a relatively low pressure, to confine the fine particle mist to the suction chamber **19**.

The suction chamber **19** is diagrammatically shown in FIGURE 1 as being of a generally bell-like form in cross section. The suction chamber **19** extends for the width of the web and is shown in FIGURE 2 as being covered with insulation **30**, extending along the advance ends thereof and insulating said suction chamber from the air knives **13** and **16** and the filter **20**. The insulation **30** also extends about a connecting flange **31** of the suction chamber to insulate said suction chamber from the filter **20**.

The suction chamber **19** at the intake of the filter **20** and in cooperation with said filter forms a conventional electronic air cleaner. Suction chamber **19** as shown in FIGURE 2, is electrostatically charged with the same polarity as the mist particles, by a terminal **36** leading from the intake through the insulation **30**, to effect precipitation of the particles prior to entering the filter **20**, in a conventional manner.

The terminal **36** is shown in FIGURE 2 as being connected to a terminal of a high voltage source **37**, by means of a selector switch **39**. The selector switch **39** may be of a conventional design and serves the purpose of connecting the terminal **36** to either the positive or the negative terminals of the high voltage source **37**. The high voltage source **37** may be a generator provided with a rectified controllably variable output in the range of 10,000 to 50,000 volts. The voltage may be varied in accordance with particle size and charge, to obtain adequate attraction of the particles without arcing across to the filter or the air knives **13** and **16**.

The filter, pump, air knives and backing roll may be suitably grounded and insulated from their supports (not shown).

With the structure just described, a high electrical potential difference between the suction chamber **19** and the filter **20** is maintained and in the event the particles are negatively charged, the suction chamber will be charged positively by operation of the selector switch **39** and the particles will be attracted to the intake to the filter and drawn therein.

In the modification of the invention shown in FIGURE 3, the suction chamber **19** is shown as having a foraminous wall **40** which may be in the form of a fine mesh screen, a porous metal, or any other porous material which will provide fresh makeup air for the filter and air knives, so as to minimize disturbance at the air knives. The mesh of the screen or porosity of the wall is such as to maintain a vacuum in the suction chamber **19**, sufficient to draw the mist through the filter **20**.

It may be seen from the foregoing that I have improved upon the coating systems for paper webs heretofore in use, in which a high pressure air knife removes and smooths the coating material, by utilizing a low pressure air knife to confine the fine particle mist in the space between the air knives, to be drawn away by suction.

It may further be seen that marking of the web by the particle mist and disturbance at the air knives is avoided by precipitating the mist particles by an electrostatic charge prior to filtering or by providing fresh makeup air for the intake end of the filter and pump, withdrawing and filtering the particle mist from the space between the air knives and thereby supplying the air knives with particle free fresh air.

While I have herein shown and described one form in which the invention may be embodied, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. A method of controlling the mist on air knife coaters comprising the steps of

removing excess coating and smoothing the coating on a freshly coated web traveling about a backing roll by impinging high pressure air along the web for the width thereof, as the web passes about the backing roll, in a direction opposite to the direction of travel of the web and generally tangential of the web,

simultaneously impinging low pressure air along the web for the width thereof and spaced in an outgoing direction from the high pressure air impinging operation and in the same direction as the high pressure air impinging operation,

confining the mist particles between the two air impinging operations and mixing the low pressure air impinged on the web with the mist particles so confined,

then withdrawing the confined mist particles by suction and filtering the mist particles as withdrawn.

2. In a paper coating machine for coating a traveling web,

means coating the web including a coating bath pan and an applicator roll immersed in the coating bath pan and over which the web travels,

a backing roll on the outgoing side of said applicator roll, the improvements comprising:

a vacuum chamber opening to the traveling web as it passes about said backing roll,

an air knife on the incoming side of said vacuum chamber and extending for the width of the traveling web and disposed to direct a smoothing blade of air on the traveling web in a direction opposite to the direction of travel of the web and tangentially of the backing roll,

a second air knife on the outgoing side of the vacuum chamber extending for the width of the traveling web and directing a mist confining blade of air on the traveling web in a direction opposite to the direction of travel thereof and supplying clean air to said vacuum chamber,

pumping means creating a vacuum in said vacuum chamber,

and filtering means between said vacuum chamber and said pumping means for filtering the mist particles from the air.

3. The structure of claim **2**,

wherein the vacuum chamber has means associated therewith for electrostatically charging the mist particles,

and wherein the filtering means filters the mist particles from the air and accommodates said pumping means to return the clean air to said air knives.

4. The structure of claim **2**,

wherein the pumping means is a two stage pump having a high pressure stage connected with said high pressure air knife for supplying air under pressure thereto, and having a low pressure stage connected with said low pressure air knife for supplying air thereto at a lower pressure.

5. The structure of claim **2**,

wherein the vacuum chamber has a foraminous wall providing fresh make up air for said filter.

6. The structure of claim 2,
wherein the pumping means is a two stage pump having its inlet connected with said filter and creating a vacuum in said vacuum chamber and having a high pressure stage connected with said high pressure air knife for supplying air under pressure thereto, and a low pressure air knife for supplying air thereto at a lower pressure,
and wherein said vacuum chamber is electrostatically charged.

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