

AIMCAL

PAPER FOR MODULE DRYER

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TITLE **RECENT DEVELOPMENTS IN AIR FLOTATION
DRYING**

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The demands placed on today's converters and paper makers are such that there is an ever-increasing requirement for the production of sophisticated products, having a variety of functional surface coatings applied to one or both sides. Such products may be coated on or off-line.

The move towards these high value added products has, in turn, brought with it a need for drying equipment which displays high heat and mass transfer effects while operating without product contact. Such equipment is essential if the high product quality specifications demanded by the market place are to be achieved in the drying phase of the coating process. These specifications dictate that the product must be free of surface contamination and all coat defects but at the same time high productivity must be attained through high operating speeds, ever increasing product widths and, of course, with minimum machine down time and reduced scrap levels.

These requirements challenge the innovative machine builder to develop new drying technologies that will pave the way for novel machine configurations and thereby provide an optimised approach to the drying process.

Recent developments utilize a combination of the most appropriate drying techniques, applied in the correct sequence and intensity while operating in a totally contactless manner.

Contactless operation in these new configurations requires advance air flotation technology to ensure absolute web stability is achieved together with contamination-free operation over a wide range of process parameters (e.g. air velocity, web tension).

A further requirement is that of an integrated design whereby all equipment can be housed inside one enclosure of minimum length, making it not only extremely compact, but thermally efficient. This, in turn, dictates the use of heating and drying technologies which can achieve high heat and mass transfer effects without compromising product quality.

The object of this paper is to introduce drying concept which has been specifically developed to meet these demands.

TRADITIONAL COATING EQUIPMENT

In the traditional multi-head off-line coater, the coatings are applied sequentially to either side of the product, while the product is supported on the uncoated side by driven or undriven web path rolls. The coatings applied to the underside dictate a reversal of the web direction, together with the re-orientation of the coating head, in order to present the wet coated surface uppermost to the web path rolls and to the subsequent drying equipment. After drying the web must now pass back over the top of dryer units before presentation to the next coating station.

This arrangement, while quite normal, is wasteful of factory space in terms of height and length and leads to tortuous web paths which may require many web rolls to achieve the

desired web run, together with the associated machine framing. The conventional coating machine configured in this manner therefore has attendant disadvantages which can be summarised as follows:-

- ◆ Each coater station has different layout
- ◆ Line is wasteful of factory space
- ◆ Many web path rolls and associated drives
- ◆ Complicated drive system and web tension control
- ◆ Problematic web paths for runnability and web feeding.

THE MODULE DRYER CONCEPT

This modular concept of coating station is extended into the design of the drying section, in that it is constructed from a series of drying modules which are arranged in a sequence that will best achieve optimum drying performance in terms of throughput and product quality.

Off-Line Coater Mode

In the typical off-machine coater the module drying sections would be positioned above the coating head and arranged in an inverted “U” configuration. In this arrangement precise web tension control is achieved by the agency of a single load cell placed on the uncoated side. This is made to modulate a fixed point drive positioned at the exit end, around the coater backing roll speed to maintain the desired tension set point. The absence of contact web path rolls ensures that an identical tension level is present throughout the whole of the drying length.

The drying module will normally comprise of a combination of drying, cooling and web handling zones, all of which are integrated into one continuous dryer housing for compactness and thermal efficiency.

The available techniques include:

- ◆ Gas fired infra-red
- ◆ Electric infra-red
- ◆ Conventional air turns
- ◆ Heated recirculating air turns
- ◆ Conventional air flotation dryers
- ◆ High performance compact dryers
- ◆ Air flotation cooling
- ◆ High performance compact cooling.

In each case the drying system will incorporate one or more 90° high performance air turn drying sections, but in general terms the system is custom designed to suit the individual process requirements.

ON-LINE COATER MODE

The concept is equally applicable to paper machine coating processes, the compact nature of the unit, together with its unrivalled heat and mass transfer rates makes it readily applicable to on-machine coated grades, particularly where there is a desire to replicate off-machine qualities.

The equipment will perform equally well with all modern on-machine coater designs, including high speed metering size presses, the concept being particularly suitable for two side application of starches and pigments. Once again the machine configuration and the actual drying techniques are selected to suit the process requirements and space availability. Typical configurations include the “hockey stick” or inverted “hockey stick” configurations.

Benefits for the Operator

- ◆ Easier cleaning (fewer rolls)
- ◆ Improved access to machine
- ◆ Cool environment (no radiant losses)
- ◆ Better building climate (no free evaporation)

Product Quality Enhancement

The unique features of the Saturn module drying concept bring product quality features not available from conventional coating machinery:-

- ◆ Contactless Web handling
 - No coating surface defects from roll deposits
- ◆ Integrated drying quality control potential
 - By expert systems using temperature and moisture scanners
 - Gel-point location control
- ◆ Web cooling potential
 - Controlled web cooling
 - Even web temperature into each cooler

Benefits for the Investor

The benefits for the investor include:-

- ◆ Integrated IR, heated air turn, flotation dryers and web cooling system
- ◆ Fewer paper rolls
- ◆ Reduced machine and building dimensions
- ◆ Reduced energy consumption
- ◆ Improved machine availability

CONCLUSION

The drying modules give totally contactless operation with high performance drying. The design features process quality management to maximise throughput without compromising product quality. The advanced air flotation system gives high web stability which, in turn, improves machine runnability. This results in reduced machine down-time, fewer web breaks and a simplified web path.