

Board Coating

4 Examples from Industry

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What is board?

The dividing line between paper and board is not always a clear one. Certain grades of board are in reality nothing more than very thick paper, although the term "board" theoretically applies to anything which has a basis weight of 200 gsm and above. These grades are usually used for making stationary products such as filing cards, bristol board, etc., which are hardly coated.

This brochure is primarily concerned with board grades used for packaging. These mainly include board for folding cartons, rigid boxboard, board for liquid packaging, corrugated board, and similar products.

The main aim of board coating is to improve the printability of the surface, and also to change the colour or degree of whiteness. Paper is coated for the same reason. The uncoated surface of board, however, is less uniform than that of uncoated paper and also more porous. This is why board frequently requires a pre-coat to level out the surface and assure the uniformity of the second or even third coat. The caliper of board is also much more prone to fluctuation than that of paper. This explains why larger quantities of coating colour are applied to board than to paper and why blade coating systems cannot be used without first applying a pre-coat.

Unlike paper, which, depending on the product range of the manufacturer can either be coated on-line in the paper machine or on an off-machine coater, board is almost always coated on the board machine. The reason is not only that on-machine board coating saves money and space, but also that board reels, have a strong tendency to curl when put into intermediate storage, which can cause problems for subsequent finishing. Furthermore, web breaks occur less frequently on board machines than

on paper machines, which means that the problem of web breaks relating to on-machine coaters is much less critical for board than for paper.

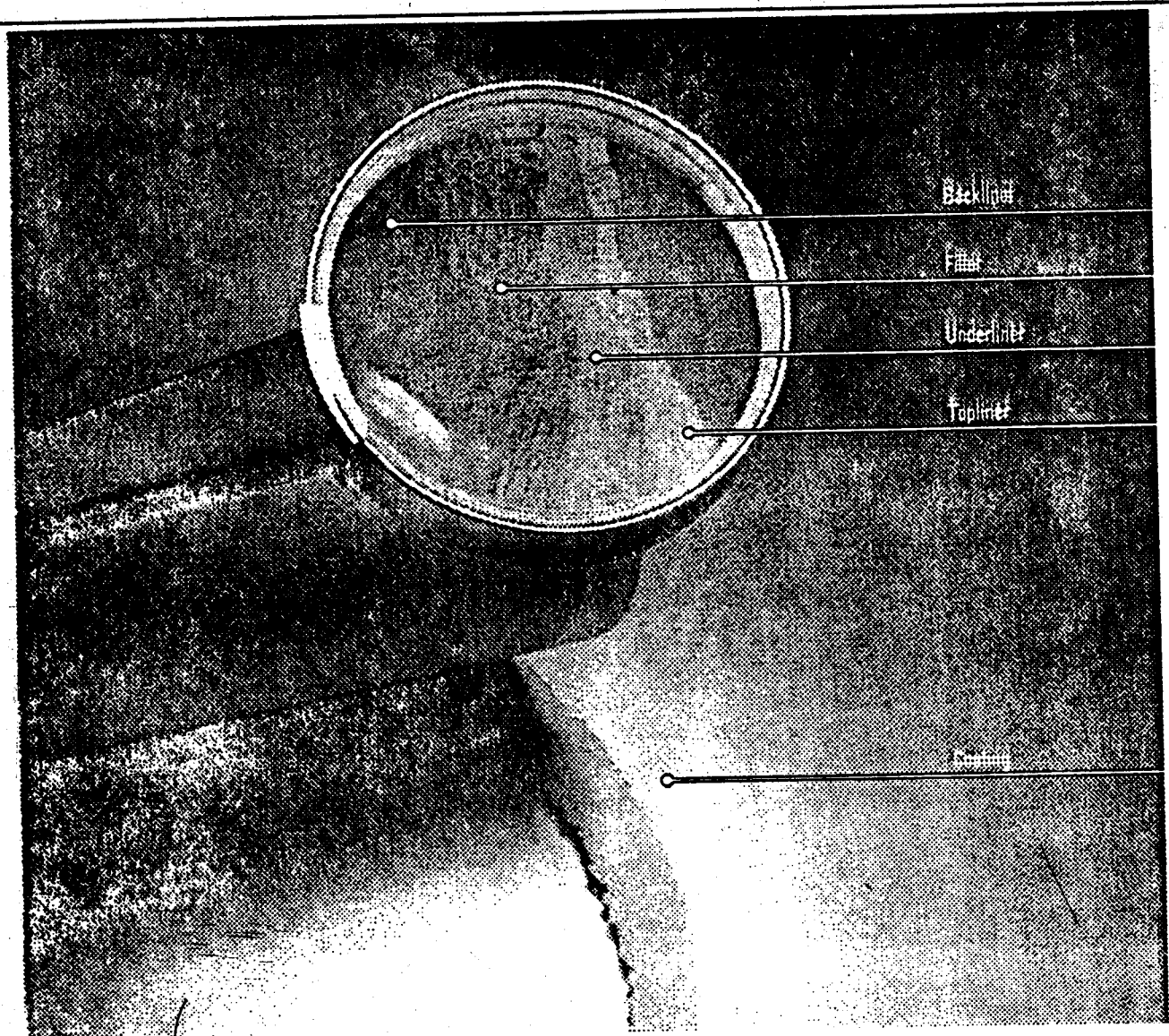
The very fact that board is coated on-machine, using relatively large quantities of coating colour in at least two, and, increasingly today, in three coats, has resulted in partly different methods being used for board coating than for paper coating.

Board machines can be of the cylinder or foudrinier machine type or can represent a combination of both these systems. This means that it is possible to combine layers which are different in composition. The web speed is considerably lower than for the paper machine. All these factors must be taken into account when planning the layout of the board coater.

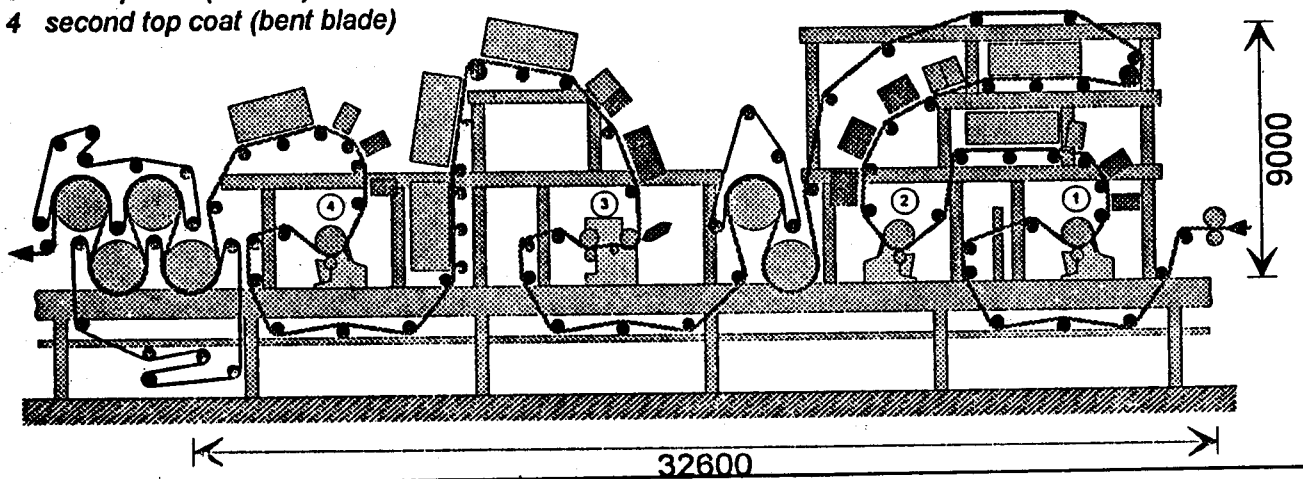
1. Folding boxboard made from re-cycled paper - triple-coated for quality.

Even as far back as the fifties, the side of folding boxboard which was for subsequent printing was furnished with a double coat - usually using the wet-on-wet method with metering rod for the pre-coat and an airknife for the top coat. More stringent quality requirements, the increased use of re-cycled paper for liner and underliner, and higher production speeds led to optimization of the coating process at the end of the seventies. Dryers were used between the pre-coat and the top coat, roll blade coating systems were used for pre-coating, coat weights were generally higher, and coating colour recipes were also improved.

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- 1 pre-coat
- 2 reverse side treatment
- 3 first top coat (airknife)
- 4 second top coat (bent blade)



The continued need to perfect the optical properties and printability of the coated surface set board makers thinking at the start of the eighties with regard to the use of three coating heads for coating the side to be printed. The first concept was worked out by the Mayr-Melnhof group in the mid-eighties and put into effect in their works in Frohnleiten, Austria. VARI-BAR was used for the pre-coat, the airknife for the first top coat and COMBI-BLADE for the second top coat. Having been successfully put into practice on both board machines at their Frohnleiten works, the on-line board coater at the Mayr-Melnhof mill in Hirschwang, Austria, was then rebuilt on this principle. The coater on one of the two board machines at their Eerbeek works in the Netherlands was also rebuilt in the same way in 1990.

This coating combination is particularly appropriate for the manufacture of folding boxboard where the liner is entirely manufactured from re-cycled paper. Unlike conventional bleached pulp, this substrate is irregular in terms of whiteness and the presence of foreign bodies and thus requires an airknife coat for achieving surface coverage of uniform whiteness. Since folding boxboard made from recycled paper also requires special printing gloss and increased smoothness, which cannot be optimally catered for by the airknife, a blade is installed for top-coating. All in all, the triple coating arrangement caters for the following:-

- * surface uniformity in terms of smoothness and absorption capacity with a VARI-BAR pre-coat.
- * increased and more uniform whiteness through application of an even, high-volume pigment coat with the airknife coating head.
- * top coating with the bent blade so that the folding boxboard made from 100% recycled paper offers optimal print gloss and smoothness.

In the autumn of 1990, this culminated knowhow was put into practical operation by the Mayr-Melnhof group on the on-machine coater (see figure 2) of their new KM 5 board machine in Neuss. The board web coming from the after-drying section of the

board machine is firstly pre-coated using a COMBI-BLADE/VARI-BAR coating head. The second coater is also a COMBI-BLADE/VARI-BAR system for reverse side treatment. This is followed by the airknife-naturally the dual airknife-for applying the first top coat. The fourth coating head carries out the second top coat and is a COMBI-BLADE system which operates exclusively in the bent blade mode.

For this coating concept, drying following each coating head is done using a combination of radiation drying (here gas-heated infrared radiators) and convection dryers (gas-heated air dryers which dry one side of the web). The evaporation performance of each of these two drying systems, i.e. the percentage of the total water quantity which each evaporates, varies, and depends on the coat weight, type of coating medium and total water quantity to be evaporated.

Following the drying section of the second and fourth coating heads, cylinder groups are arranged comprising either two or six felt-covered cylinders. These serve the purpose of after-drying and also function as a fixpoint for the multi-motor drive.

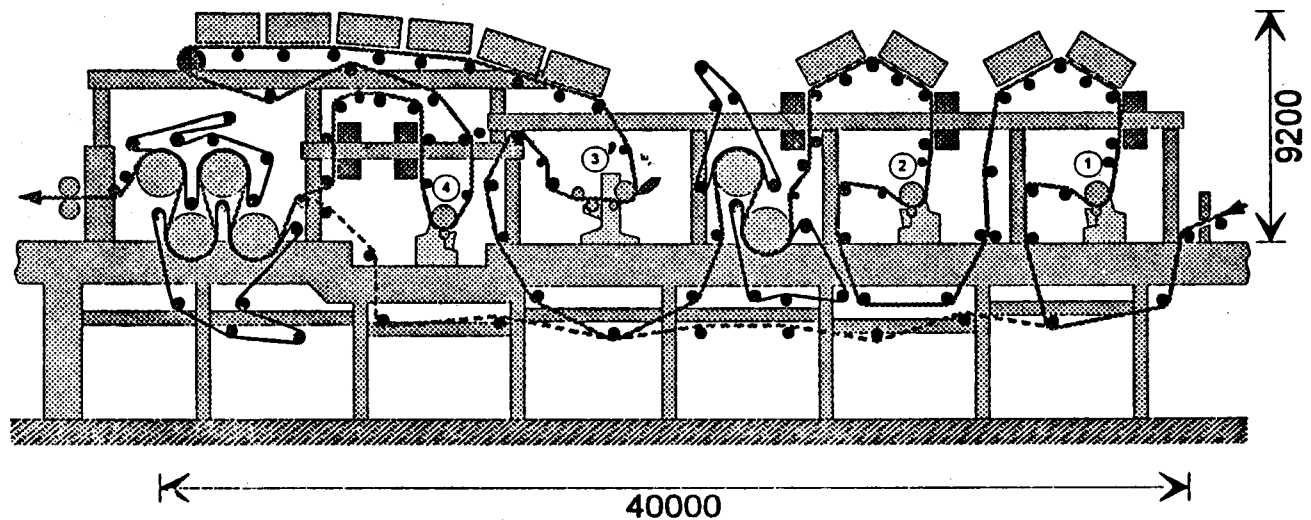
Since 1985, JAGENBERG has installed this concept in as many as 15 mills worldwide. On all of these plants, this coating arrangement helped to bring about a significant improvement in opacity, smoothness and print gloss. In addition, the amount of lacquer subsequently required in the printing machine was also reduced.

2. Brown becomes white. Unbleached kraft board for making liquid packaging and folding boxboard.

Board and paper are primarily coated to improve their printing properties. Improving the whiteness of the substrate is also an aim of coating. However, when the substrate is unbleached kraft board, special measures have to be taken, not only to create a fine surface for printing, but also to give the board pure, uniform whiteness.

Although it was installed as far back as the start of the eighties, the board machine bought by Frovifors Bruk AB in Frovi, Sweden, a member of

- 1 first pre-coat
- 2 second pre-coat
- 3 top coat
- 4 reverse side treatment



the Swedish state-owned ASSI group, provides an excellent example of board coating an unbleached substrate. The use of unbleached fibres makes for increased board strength, which is particularly important for liquid packaging, bottle carriers, and folding boxboard. Today, environmental consideration as well play a special role.

Numerous coating trials were systematically carried out on pilot equipment before finalizing the coating concept. Here the aim was to establish which coating systems, how many, and in which combination could be effectively used to achieve all the stringent requirements posed with respect to the white coated surface.

The finished concept comprises three coating heads for the good side and one coating head for the reverse side. This concept, elaborated at the start of the eighties, marked a significant advance in the field of board coating, and is the coater concept predominantly used today for coating unbleached substrates or board made from re-cycled paper.

The coating concept as shown is laid out with two COMBI-BLADE coating heads for applying the first and the second pre-coat to the side of the board which is to be printed. Both coating heads can be

run either in the rigid or bent blade mode, as required. Both these coating heads are equipped with the VARI-BAR metering system. Coat weights in the range 8-15 gsm can be applied by each of these.

The airknife coating head which follows provides good, uniform coverage of the calendered surface through application of a high-volume coat. The coat weight is between 10-20 gsm.

The airknife coater in question is a dual airknife of 6850 mm untrimmed width, the widest airknife coater of its kind in the world at the time of installation. The airknife body can be pivoted and is arranged with two identical air nozzles on each side. Thus one nozzle and airknife lips can be cleaned while the other air nozzle is in working position. In order to assure constant coat weights and quality, even during the 40-second nozzle switchover, high priority was given to precision design.

Coating head no. 4 is a VARI-BAR system for treating the reverse side of the board. The application of weak solutions of starch or CMC not only promotes the flat lay of the board but also fibre bonding.

The length of the dryer section which follows each coating head and the type of dryers which are

used depend on the quantity of water to be evaporated and the available energy, amongst other technological considerations. For this plant, exclusively steam-heated hot air dryers were selected for drying both pre-coats. Each dryer dries one coated side only.

Following the hot air dryer at the second coating head are two felt-covered drying cylinders which first and foremost serve as a fixpoint for the multi-motor drive. The high-weight, high-water content coat which is applied by the airknife is firstly immobilised using electrically heated infra-red radiators, and then dried using six steam-heated hot-air dryers which dry one side.

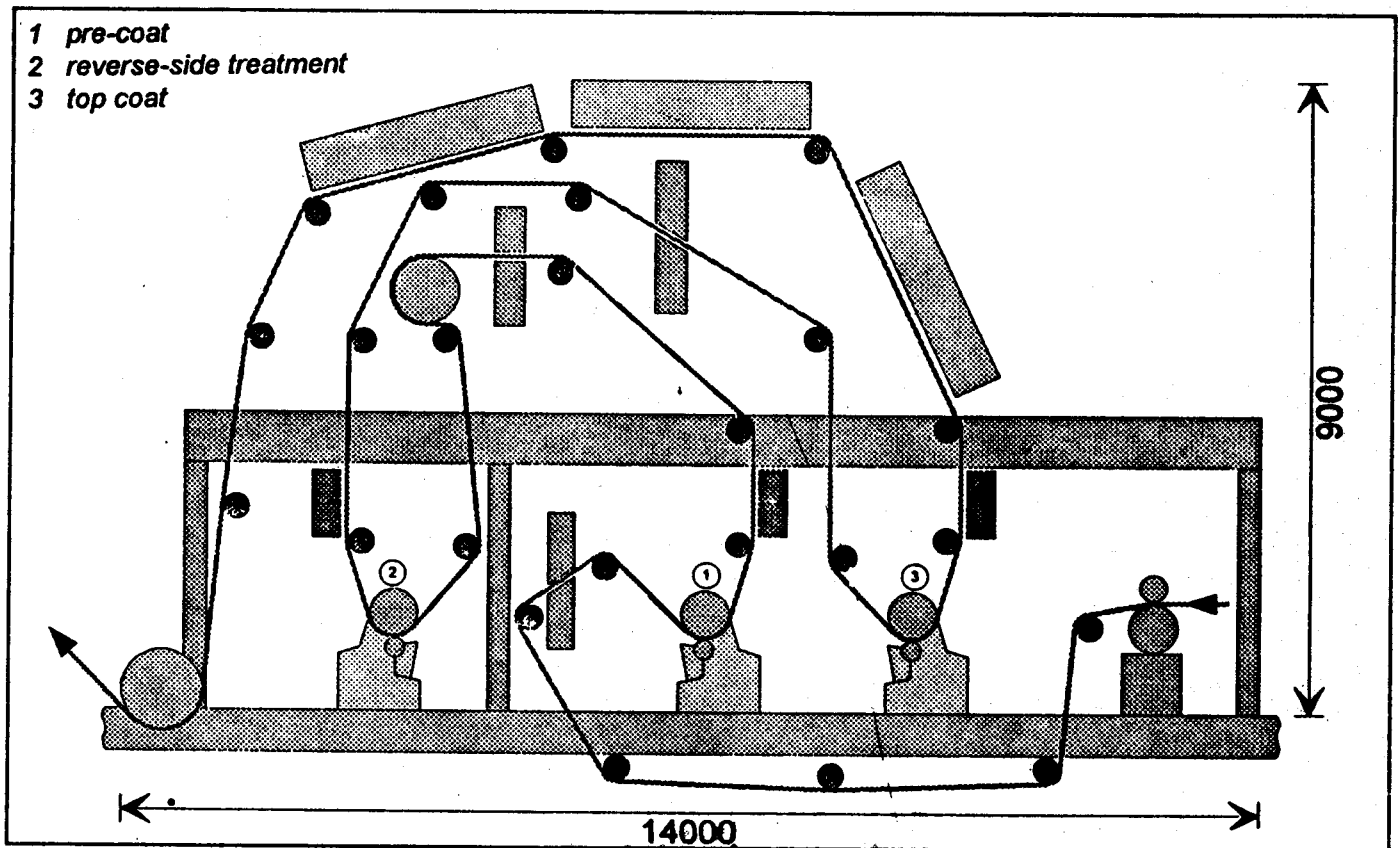
Two steam-heated hot air dryers follow the coating head for reverse-side coating. These are followed by four felt-covered cooling/ drying cylinders.

3. Board manufacture and quality improvement - an ongoing challenge

Adherence to traditional methods is no guarantee for future success ! Each enterprise must con-

stantly look for new ways of increasing quality. The Tako Board Mill in Tampere, Finland, now owned by the Metsa-Serla concern, is an example of a company which has successfully followed this aim. As far back as the fifties, this company was already one of the world's leading manufacturers of clay-coated board and bleached folding boxboard. In the fifties, coating heads equipped with airknives were used for coating these board grades and these were expanded in the years which followed with various pre-coating equipment.

In order to maintain their traditionally high quality standards, the board mill decided at the start of the eighties to carry out a thorough rebuild of board machine no. 3 which had a working width of 3350 mm. The on-machine coater was to be included in the re-build in order to satisfy the most stringent requirements for rotogravure and offset - printing papers. Tako Board Mill decided on the installation of a total of 3 COMBI-BLADE/VARI-BAR coating heads. In order to create the optimum surface for rotogravure and offset-printing, the existing airknife coating head was used in addition to the COMBI-BLADE/VARI-BAR for the top coat. The



airknife coater was then removed from the line several years later.

The coating head in board machine no. 1 was also optimized, and following positive results, it was decided to equip board machine no. 2 with a new on-machine coater (see figure 3). Like board machine no. 3, this production line is laid out for a maximum board web width of 3350 mm, and manufactures coated boxboard between 230 and 400 gsm in the 100-200 m/min. speed range.

The surface is firstly prepared for coating by pre-treating on both sides using a coating head designed by the board mill itself. Three COMBI-BLADE coating heads are then used for the pre-coat and the top coat on the good side and for reverse-side treatment. These can be run either in the rigid blade or bent blade operating modes. The mode preferred for all three coating heads is the bent blade mode. All three coating heads can be retro-fitted with the VARI-BAR metering system as required.

As was successfully put into effect on board machine no. 3, gas-heated infrared radiators only are installed following the coating heads for the second pre-coat and for reverse-side treatment. The top coat is dried using a combination of gas-heated infrared radiators and steam-heated hot-air dryers.

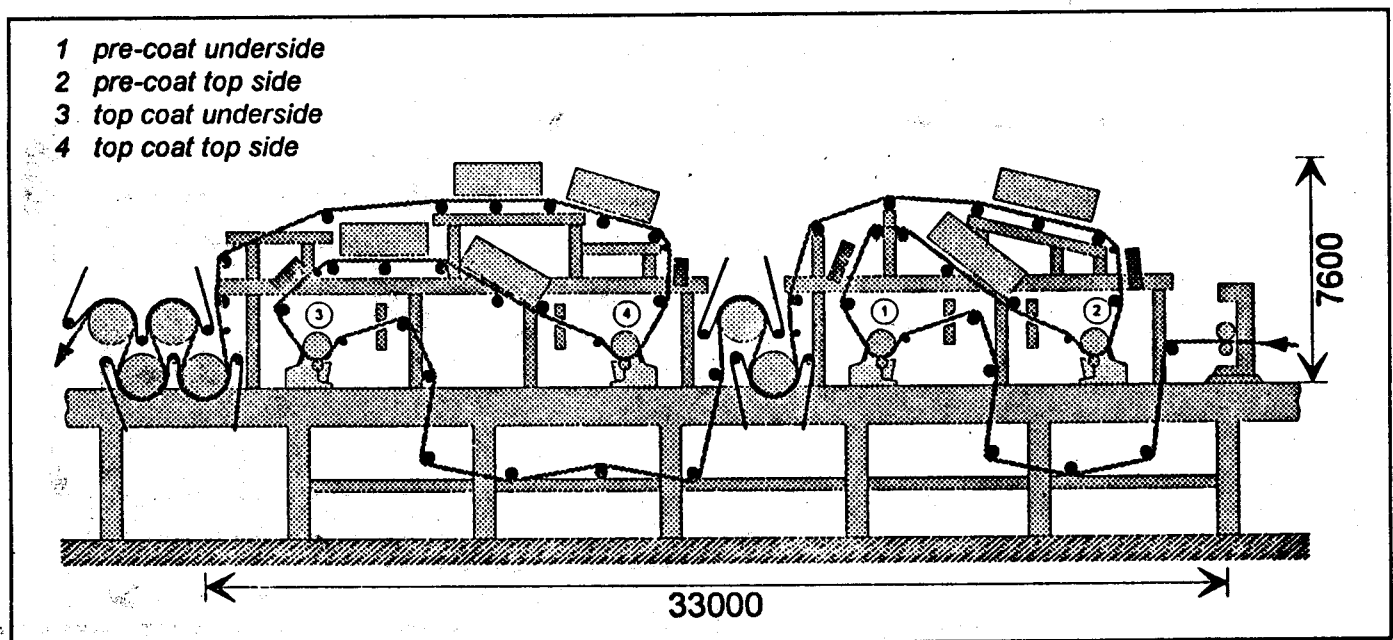
Tako Board Mill has three board machines for

manufacturing a variety of board grades: KM 1 primarily coats board used for up-market cigarette packs. KM 2 produces board for cosmetic packaging and KM 3 coats all board grades destined for subsequent writing and printing. With these three coaters, Tako Board Mill is able to sell board of first-class quality, tailor-made for the end user's requirements.

4. Kraft board for writing and printing, of illustration printing quality and coated on-line.

Although not in production for the packaging sector, the following coater which produces board for writing and printing purposes is still worth a mention. The quality of the end product is such that it is even purchased by market sectors which previously relied on illustration printing papers.

The Enso-Gutzeit company in Kaukopaa, Finland, is a long-standing manufacturer of blade-coated board. Their first blade coater was commissioned in 1958 for producing board for foodstuff packaging. In 1991, Enso-Gutzeit commissioned board machine no. 2, newly rebuilt at the wet end, press section and end section. This rebuild had been carried out first and foremost for the manufacture of a new illustration kraft board for writing and printing. With its higher strength, and easy runnability for further processing, e.g. for die-cutting, grooving or embossing, this material presents illustrating printing papers with a new competitor. This type of board is



particularly suitable for the face covers of catalogues, company reports, invitations, menus, calendars and posters.

Each side of the board is coated either once or twice, depending on the finished grade required, and for this an on-machine coater with 4 coating heads is available. The first and second coating heads are used for a two-sided pre-coat. The coating heads in question are all COMBI-BLADE coating heads, with metering possible either in the bent blade or rigid blade mode.

The VARI-BAR metering system can also be used as an alternative to the blade. Gas-heated infrared radiators and gas-heated air dryers are installed following both coating heads for drying. The pre-coat coat weight is between 8 and 14 gsm per side.

The drying section comprising two drying cylinders is then followed by the top-coating section. This also comprises two COMBI-BLADE coating heads equipped with the same metering systems as the COMBI-BLADES for the pre-coat. Here as well, the coat is dried firstly by pre-drying with gas-heated infrared radiators, followed by gas-heated air dryers. The dryer capacity for the top coat is

higher than for the pre-coat. This provides a flexible drying system which can be adjusted to suit various coating colour recipes of various solids content and pigment types.

With its new coater concept, Enso-Gutzeit conquered new markets for multi-ply board, once again setting an example for the industry. Coater concepts based on this model have since been put into operation by other board mills.

The coater plants which have been presented in this bulletin demonstrate coater concepts which can be used for manufacturing a diverse range of end products. When planning a given concept, the particular wishes of the mill, its own experiences in production, and the given operating conditions must all be taken into account. This means that no one finished plant is exactly like another. Quite regardless of the final concept which is decided upon, it is the flexibility of the applying systems, drying systems and drives which is of primary importance. The machine user, constantly confronted with new market requirements and changing quality standards, shall only meet this challenge if his long-term manufacturing investment is in machines with in-built flexibility.