

# FILMPRESS

## A versatile coating system

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*ABSTRACT:- All examples discussed here show that, since its arrival on the market at the beginning of the eighties, the FILMPRESS has developed into a coating system which makes a positive contribution to economical production and quality in the manufacture of a broad range of papers and boards.*

*Surface-sizing upto 2 gsm per side, pigmentizing upto approx. 5 gsm per side and coating upto approx. 10 gsm per side are standard applications. By optimising coating colour recipes and roll coverings, even higher coat weights can be achieved. Moreover, different coating media may be applied to the wire side and the felt side within one and the same system, without compromising other characteristics such as function or quality.*

*The continuing efforts of machine users, raw material suppliers and machine-builders will open up new areas in which the FILMPRESS can also be used to improve the quality of the final product and streamline production.*

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### INTRODUCTION

The use of an applicator nozzle with size press rolls was first tried out in 1982 on a pilot coater of 500 mm width. The main aims of these tests were:

- \* to apply a water-based starch solution of higher solids content than was possible at the time using the conventional size press.
- \* to improve the operating conditions of the size press, particularly at speeds over approx. 800 m/min., by eliminating the pond at the roll nip.

These tests showed very positive results and this principle became the ultimate in surface sizing paper at high operating speeds.

Attempts made at the same time to pigmentize paper did not indicate that better results would be possible with the FILMPRESS than could already be obtained with other roll coating systems such as the gate-roll coater, the Massey coater etc.

However, as new insight was gained into the

mechanics of pre-metering on a roll surface and applying a pre-metered film to a substrate in the roll nip, and as market demands within the paper industry itself underwent change, new areas of application also emerged for the FILMPRESS.

The aim of this paper is to present and discuss some of these new applications.

### THE FILMPRESS SYSTEM

Coating systems which consist of two rolls for applying a pre-metered film of coating medium to both sides of a paper or board surface have been used in paper and board machines for decades. Roll-coating systems such as the gate roll coater, the Massey coater and the KCM coater count amongst the predecessors of the FILMPRESS.

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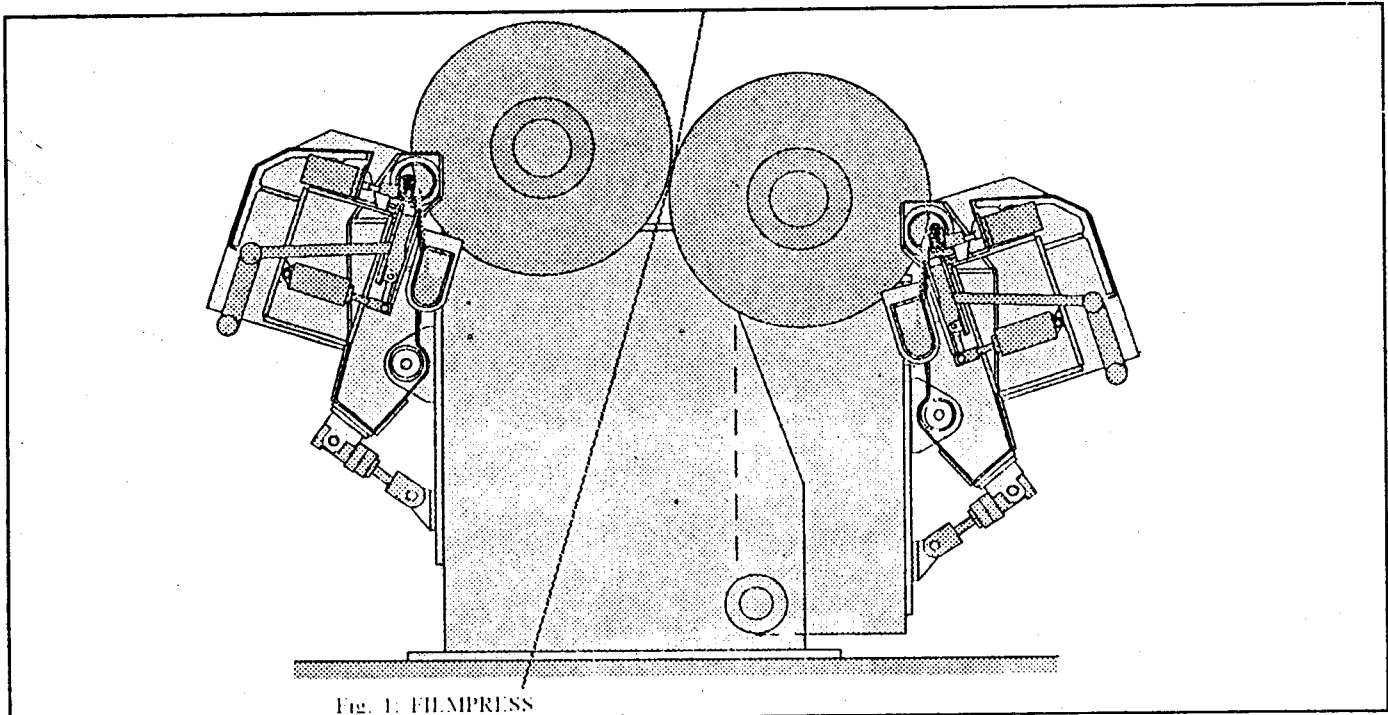


Fig. 1. FILMPRESS

<p>high blade pressure</p>	<p><b>Leveling coating with rigid blade</b> good smoothness relatively ununiform coverage</p>
<p>contactless metering</p>	<p><b>Airknife - contour coating</b> minor smoothness best coverage</p>
<p>nip pressure</p>	<p><b>FILMPRESS - contour coating</b> minor smoothness more or less acceptable coverage</p>

Fig. 2: Surface Quality Depending on Coating System

In the FILMPRESS system, jet applicators similar to those on the short dwell coater are used instead of metering rolls (Fig. 1).

To meter the film which is applied to the transfer rolls, smooth or profiled metering rods of various diameters are used. Optional ancillary equipment

also allows take-up of the bent blade metering system. One metering element can be exchanged for another to suit the particular area of application.

It is also important to consider what type of coat surface can be achieved using the FILMPRESS (Fig. 2). In contrast to the blade coat, which is made

by metering away the excess coat applied to the web and whose outstanding quality is smoothness, the FILMPRESS coat, which is applied to the substrate in the roll nip, follows to a greater extent the contour of the paper surface.

The term "contour coat" is used in conjunction with the airknife. Yet the FILMPRESS contour coat cannot be compared to that of the airknife! The coat metered by the airknife not only follows the contours of the web but also possesses a certain volume. The pigment, which is distributed at random on the paper, is metered by the airknife without contact, producing excellent coverage.

On the FILMPRESS, the film of coating colour is firstly compressed in the roll nip. As the nip diverges, filmsplitting takes place and the colour film is subject to "picking". This reduces the smoothness of the coat surface and as a result of filmsplitting, coat formation tends to follow the contours of the web surface. In terms of smoothness and coverage therefore, the FILMPRESS ranks second to the blade for smoothness and second to the airknife for coverage.

These two limitations, however, have not stood

in the way of the FILMPRESS, whose advantages obviously predominate:

- \* simultaneous application on both sides of the web-even with different coating media
- \* uncomplicated on-line design of excellent runability in all speed ranges
- \* low pressure in the roll nip, low mechanical stress on the web and as a result a generally low propensity to web breaks
- \* low coat weights which can only be achieved on the blade coater with a loss in efficiency and quality
- \* relatively low space requirement
- \* relatively low investment costs

### SURFACE SIZING AND PRE-COATING IN THE BOARD MACHINE

Up to the beginning of the seventies, board machines were usually equipped with size presses in order to improve the pick resistance and bonding strength of the board. Surface sizing also helped to even out absorption capacity over the board surface in preparation for the coating procedure which

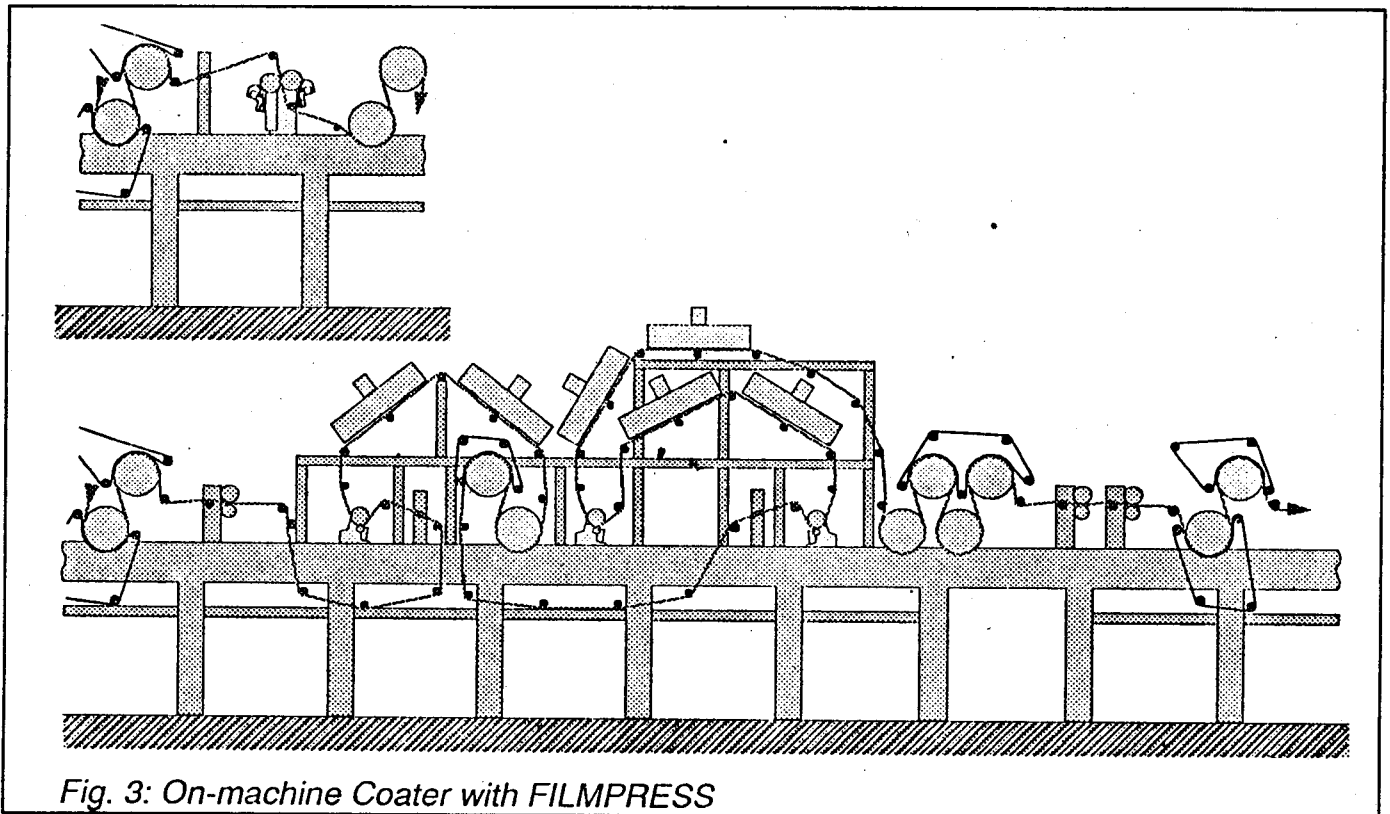


Fig. 3: On-machine Coater with FILMPRESS

usually followed.

Changes in raw materials, developments in sizing stock and the demand for higher-bulk board led to the building of new board machines without size presses, and the removal of size presses from existing ones.

In recent years, the quality requirements for coated board have become more and more stringent, and three coating heads are commonly used for coating the good side. The third coating head serves to enhance smoothness, print gloss and coverage. This increase in quality, however, is only possible with extra investment.

In their search for a compromise between high investment and the attainable increase in quality, some manufacturers have opted to install a FILMPRESS ahead of the coater.

Fig.3 shows the arrangement of the final group on a board machine laid out for a maximum working width of 4250 mm and a maximum production speed of 500 m/min. Here the FILMPRESS is used for surface-sizing both sides of the board or for applying a pre-coat to the wire side with simultaneous reverse-side treatment with starch. it is also pos-

sible to pigmentize the reverse side in order to heighten optical quality.

The preferred metering method is the profiled metering rod (see Fig.4). In the course of its development, various designs of metering rod have been used. To date, the rod with a machine-made profile has proved the most popular as the wire-wound rod causes damage to the transfer roll if wire breakage occurs, and the quality of the coat achieved by the laser-produced profile is not yet sufficiently high.

The FILMPRESS system, which works on the volumetric principle (Fig.5), is able to produce a mark-free coat. The coat is highly uniform in both machine and cross-machine direction. In contrast to the conventional type of size-press, the pressure in the roll nip is low, so board bulk remains constant. On the whole, this system is very reliable and should only require a minimum amount of monitoring.

Depending on the type of profile selected, starch application of upto around 2 gsm per side with solids contents upto approx. 15% is possible, independent of the machine speed (Fig.6). Using coating colours, coat weights upto and exceeding approx. 10 gsm can be applied, depending on the

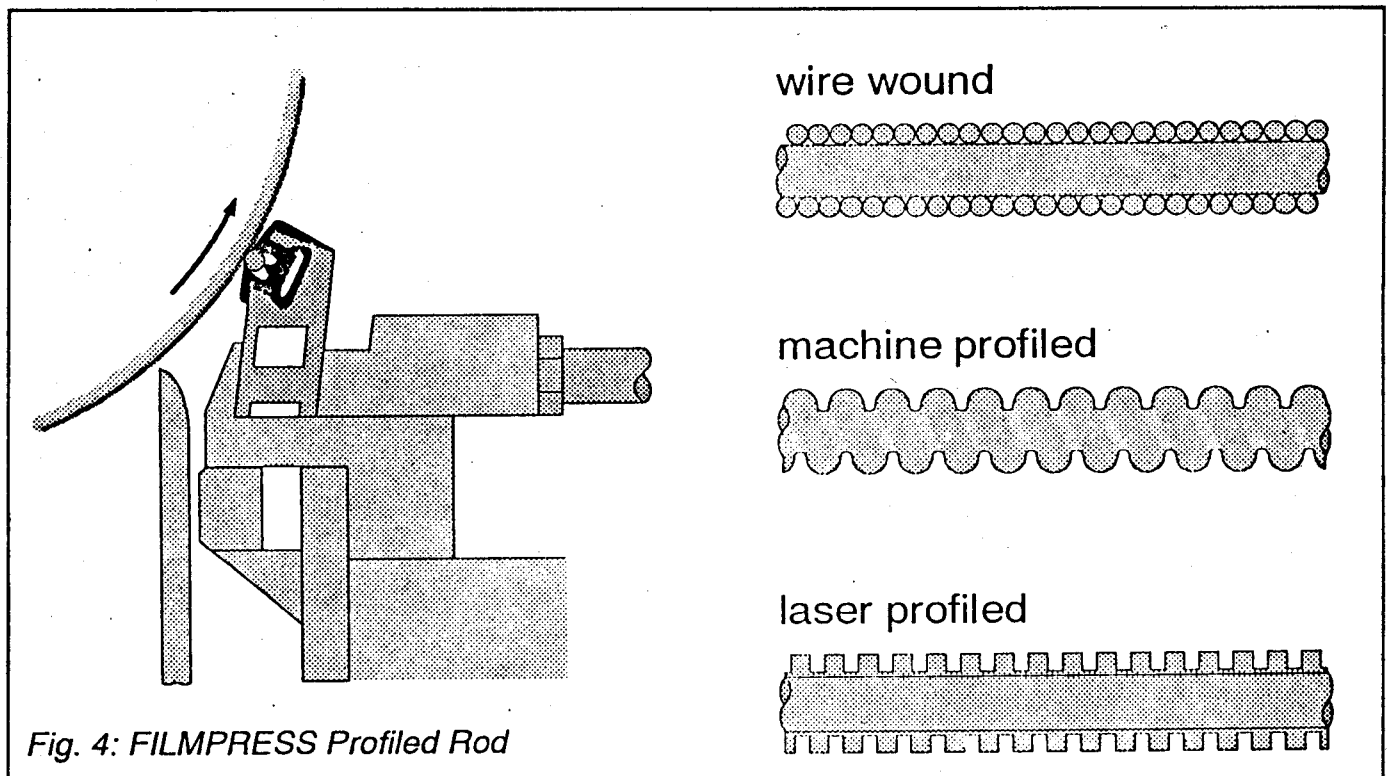
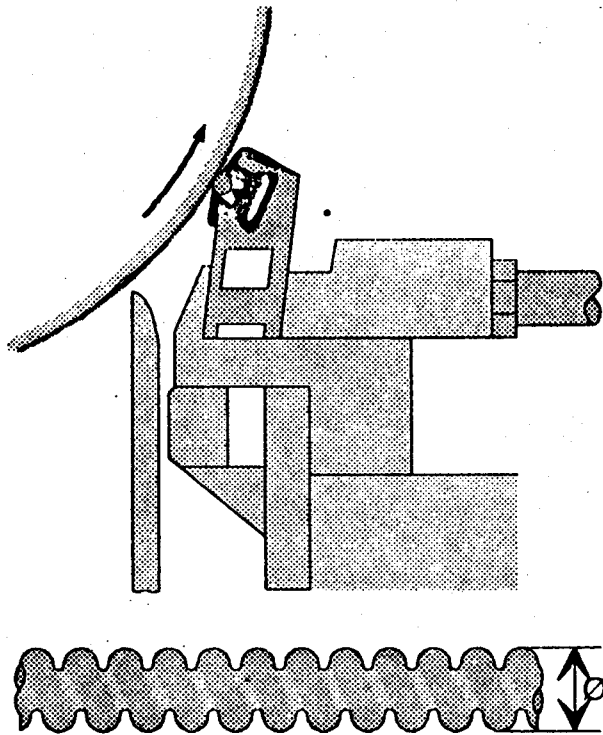


Fig. 4: FILMPRESS Profiled Rod



**Application (guideline values)**

- \* size solution upto 15% solids content
- \* coatings upto 60% solids content
- \* speed upto 1500 m/min

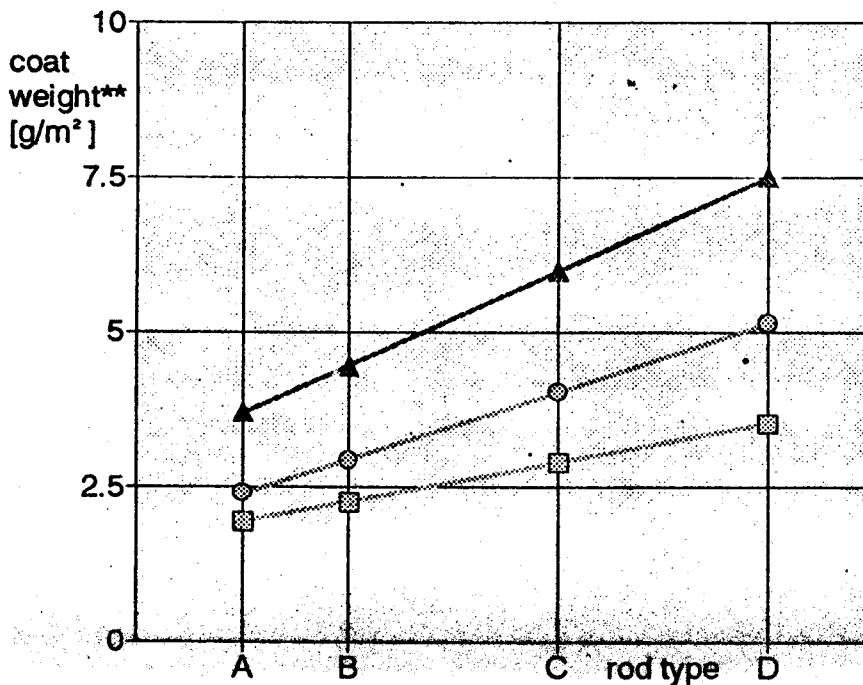
**Advantages:**

- \* virtually no scratches or other coating defects easy operation
- \* uniform film quality in length and cross direction

**Disadvantages:**

- \* insufficient service life when coating with abrasive pigments
- \* coat weight variation in length and cross direction restricted

Fig. 5. Advantages and Disadvantages of the Profiled Metering Rod



rod type	wire Ø
A	0.25 mm
B	0.30 mm
C	0.40 mm
D	0.50 mm

▲	theoretical
●	0 P+J*
■	15 P+J*

\* = Hardness of Roll covering  
 \*\* = Solids content 15%

Fig. 6: FILMPRESS Profiled Rod 12 mm diameter - Coat Weights

rod profile, solids content and hardness of the roll covering.

This coater concept also allows for installation of a calender ahead of the coater in order to improve the smoothness of the pre-coated board. In the coater, the wire side of the board is coated by two blade coating heads. A VARI-BAR coating head is also available for additional reverse-side treatment.

At lower investment and production costs, this coater concept enables a board quality to be attained which comes very close to that achieved by the conventional triple-coating method e.g. the combination: VARI-BAR/COMBI-BLADE/COMBI-BLADE.

### FILMPRESS-COATED LIGHTWEIGHT PAPERS

The profitability of a paper machine of 3350 mm working width for manufacturing supercalendered rotogravure papers and offset papers compared poorly to that of wider installations. Even attaining the maximum speed of almost 1,400 m/min. failed to improve the cost-effectiveness of the plant to any notable extent, which is why the mill decided to switch to coated grades in order to increase the value added.

Production costs were to be kept low by selecting reasonably-priced raw materials and machinery. Care was also taken to ensure that the planned

increase in the proportion of recycled paper and simultaneous reduction in the basis weight would not have a detrimental effect on other quality factors such as whiteness, opacity and printability.

The choice of production process was based on the mill's own experience in the operation of various off-line coaters as well as on the results of comprehensive tests carried out on pilot machines.

As a result of these considerations, the customer chose the FILMPRESS system!

The grounds for the customer's decision were primarily technological. Whilst the FILMPRESS is an ideal system for applying very low pigment coats of about 2 gsm per side, the tests also demonstrated that very high coat weights of up to 10 gsm per side could be achieved without exerting high mechanical stress on the relatively thin paper. Even when operating the equipment at the highest speeds and with the lowest basis weights, a very low web break frequency could be expected which is an essential condition for the economic operation of a production line.

In terms of investment too, which was relatively low in comparison to the on-machine coater with two coating heads or the off-line coater, the FILMPRESS was clearly the more attractive option.

The FILMPRESS (Fig.7) was installed in the final group of the paper machine.

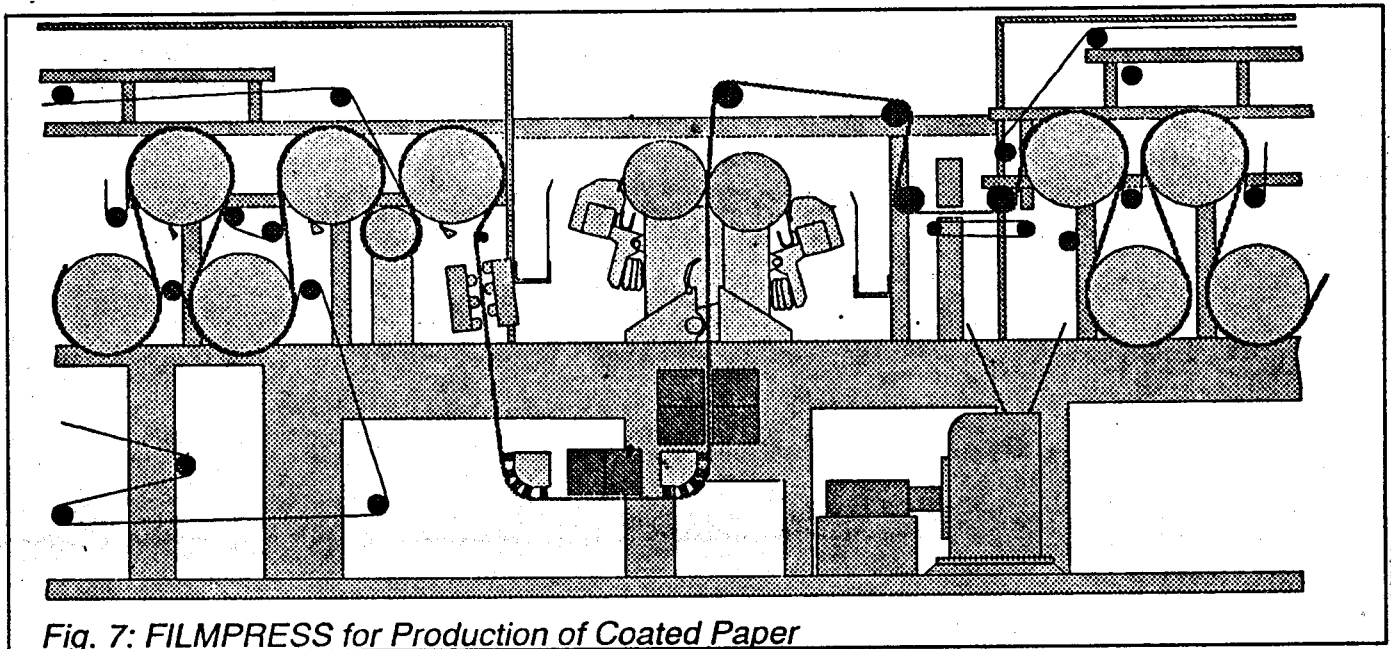


Fig. 7: FILMPRESS for Production of Coated Paper

A maximum production speed of 1,400 m/min. and a coat weight requirement of upto 10 gsm per side necessitated the installation of additional drying capacity between the FILMPRESS and the first drying cylinder. Gas-heated infrared radiators were selected, arranged for drying both sides of the web. The dry content of the coated web on arrival at the first drying cylinder of the after-drying section is approximately 90%. In order to prevent marking to the web surface, particularly when running high coat weights, the web turn between the FILMPRESS and the first after-drying cylinder is performed using air cushions (air turn) rather than cooled guide rolls.

A multi-motor drive with web tension regulation was installed. A pair of load cells is located between the pre-drying section and the FILMPRESS, the second draw measurement point is located at the second airturn.

Despite installation of the coater for two-side coating and the use of substrates of lower-than-average basis weight, there was no increase in the number of web breaks. The finished product not

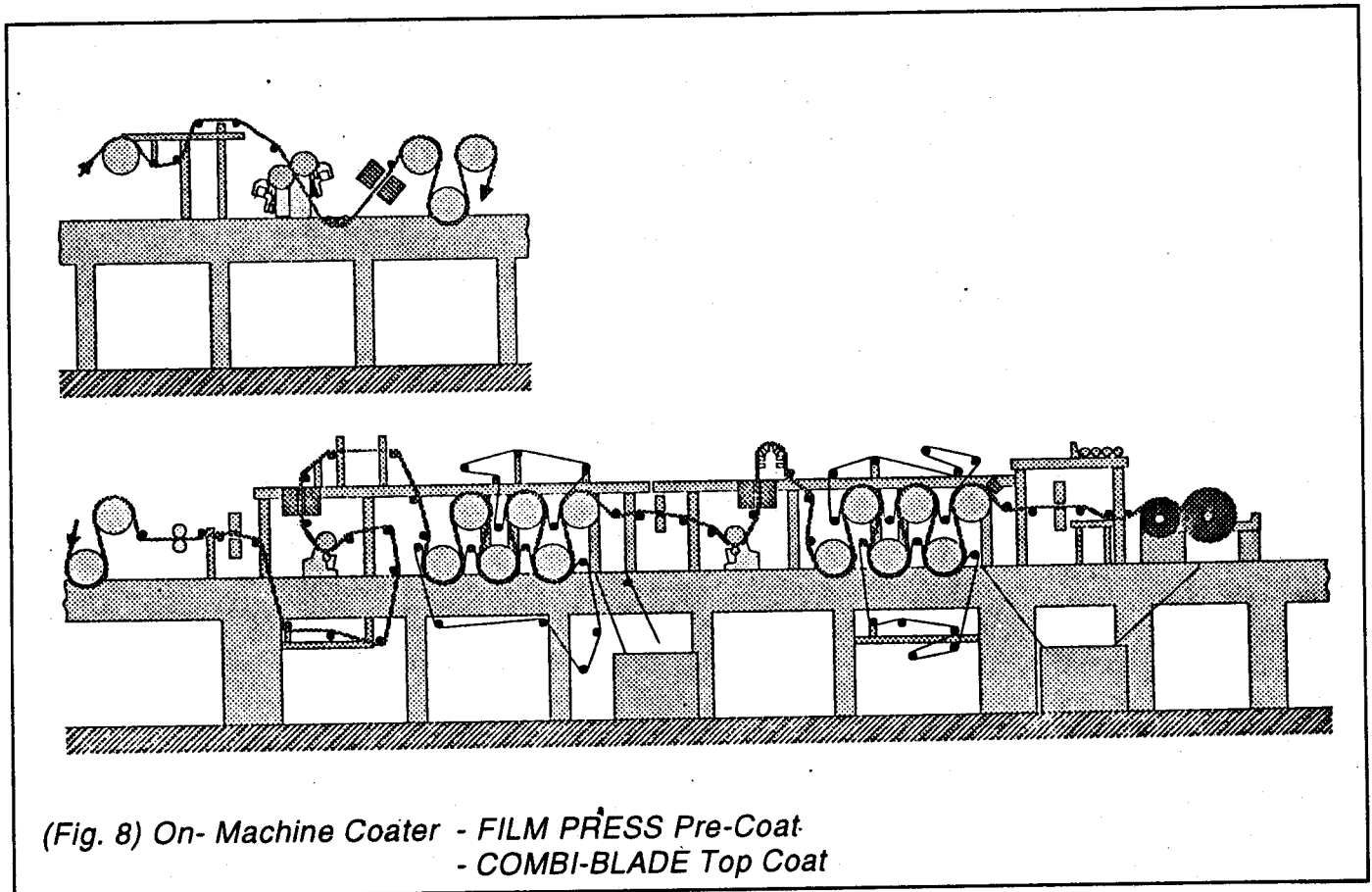
only meets the paper mill's expectations-printers too are more than satisfied!

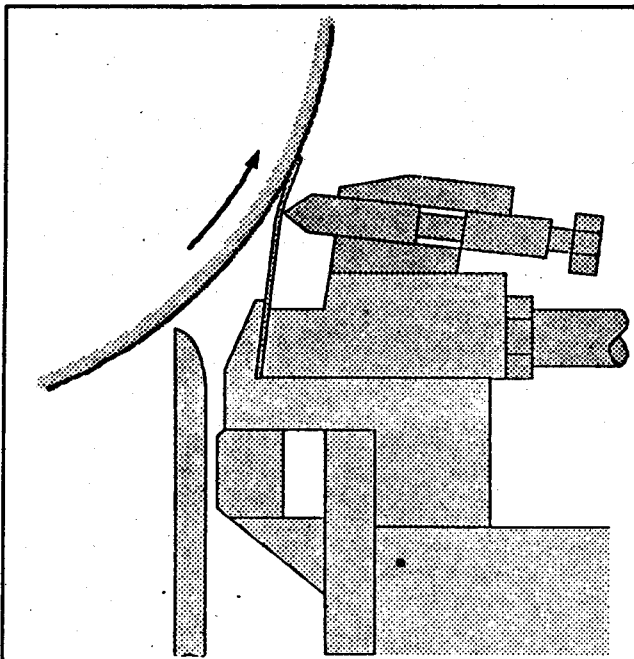
### ON-LINE COATING WITH FILMPRESS PRE-COAT, COMBI-BLADE TOP COAT

A new paper machine of working width 5200 mm with a maximum operating speed of 800 m/min. was to be installed, with an on-machine coater planned for the pre-coat and top on coat. (Fig.8)

On the basis of past experience, selecting two blade coaters for the two-sided top coat was a fore-gone conclusion for the mill, even at the planning stage. For the pre-coat, however, the advantages and disadvantages of various pre-coating systems such as the size press, the billblade, the gate-roll coater and the FILMPRESS were examined and discussed.

The aim was to apply pre-coats of 2-5 gsm per side using one system ahead of the coaters for the top coat. The final decision was in favour of the FILMPRESS, which offered a choice of 3 different metering systems.





**Guideline values for application:**

- \* highly viscous colours  
>800 mPas: V <500 m/min
- \* colours of medium viscosity  
<800 mPas: V <1000 m/min
- \* colours of low viscosity  
<300 mPas: V >1000 m/min

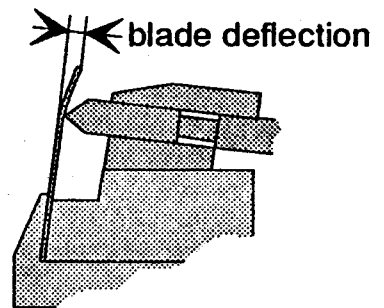
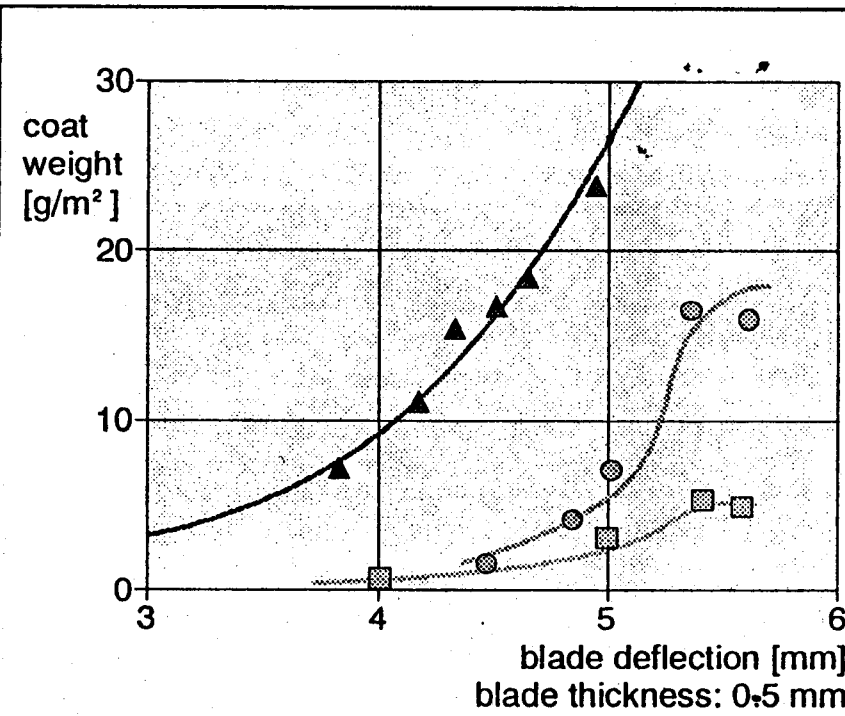
**Advantages:**

- \* stepless coat weight setting
- \* adjustable cross profile
- \* good service life: cost ratio
- \* short changeover time

**Disadvantages:**

- \* tends to produce scratches
- \* requires high mechanical accuracy
- \* tends to cause streaking at high speeds

Fig. 9: Advantages and Disadvantages of the Bent Blade



	solids content	speed m/min
▲	58%	360
●	50%	360
■	30%	600

Fig. 10: FILMPRESS Bent Blade - Coat Weights

For various reasons, the mill opted for the bent blade metering system(Fig.9).

The essential advantage of the bent blade over the profiled metering rod is its stepless coat weight setting facility (Fig.10). The coat weight cross-pro-

file can also be influenced via profiling screws.

Running costs present a further advantage. In terms of service life, the blade is more economical than the profiled rod.

The drawback of the bent blade, however, is



the risk of scratches and streaking at high speeds. Moreover, the investment cost for a FILMPRESS system which can be run with the bent blade is higher than for a system which only allows smooth or profiled rods.

On account of the water quantities to be evaporated, the coating concept for this line also included an airturn and infrared radiators following the FILMPRESS (Fig.8). The two COMBI-BLADE coating heads for the top coat were installed following the cylinder section. This manufacturing line produces matt and gloss papers, and the FILMPRESS pre-coat has made possible a considerable improvement in smoothness and print gloss. In the production of gloss papers, the FILMPRESS pre-coat allows lower pressure at the calender which especially promotes stiffness and gloss.

#### **FILMPRESS PRE-COAT IN A PAPER MACHINE**

A production line for woodfree, two-side coated papers comprised a paper machine of 4300 mm working width, operating speed 1200 m/min. and an off-line coater of the same width for two-side coating, operating speed 1350 m/min. This line was optimised by exchanging the existing size press for a FILMPRESS.

Prior to the rebuild, surface sizing was done in the paper machine. A coat of 15-25 gsm per side was then applied in the off-line coater.

Installation of the FILMPRESS improved the efficiency of the paper machine (Fig.11). The paper machine production speed could be slightly increased and the number of web breaks dropped significantly.

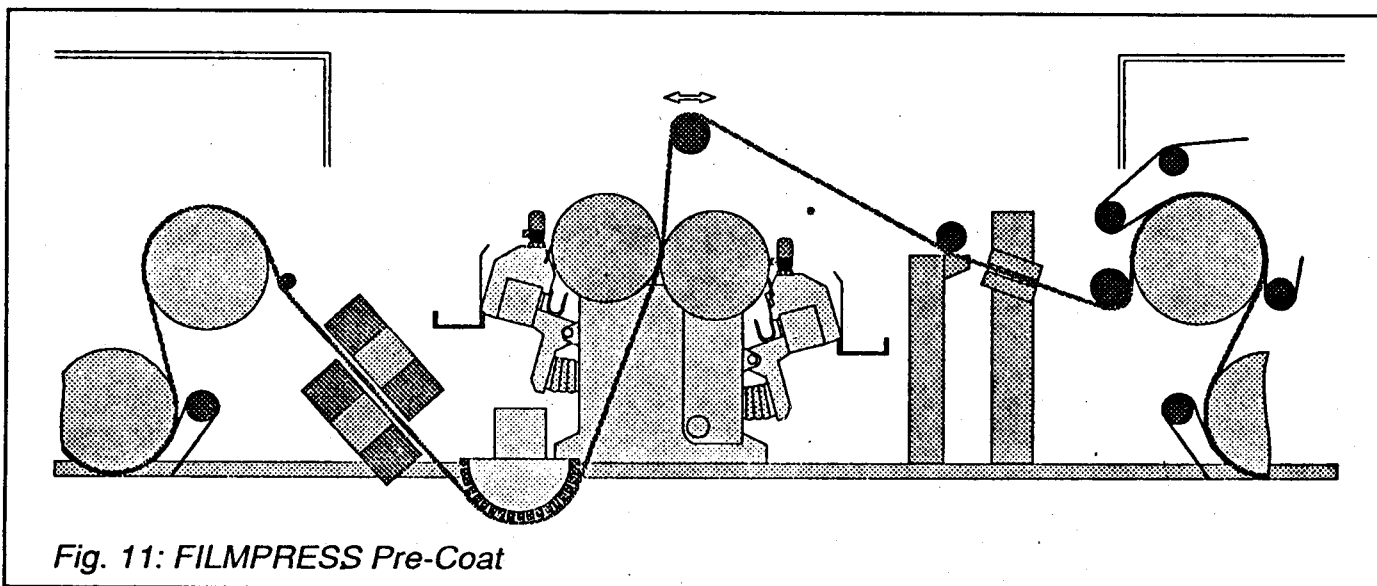
This coating concept again included an airturn between the FILMPRESS and the following cylinder group to turn the web without contact, with infrared radiators for drying both sides of the web. This ensures that the dry content which is required to prevent marking as the web enters the cylinder group has been attained before the coated web comes into contact with the first drying cylinder.

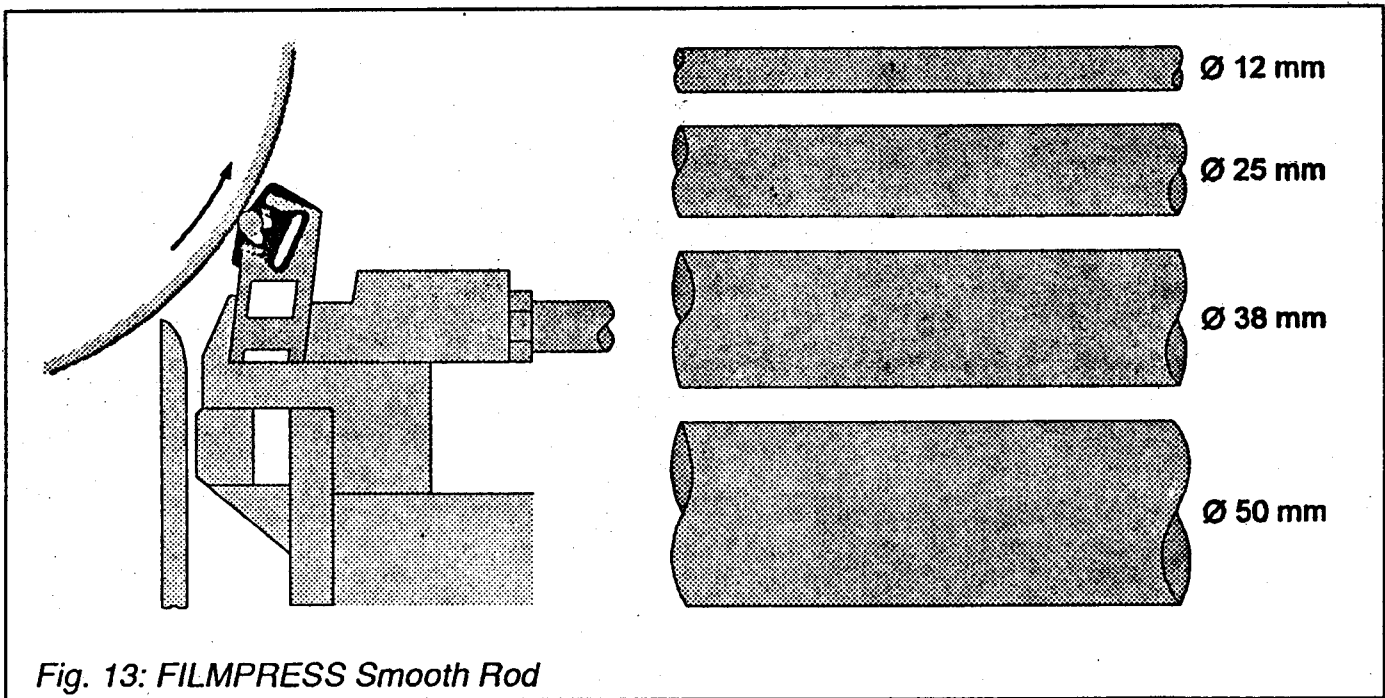
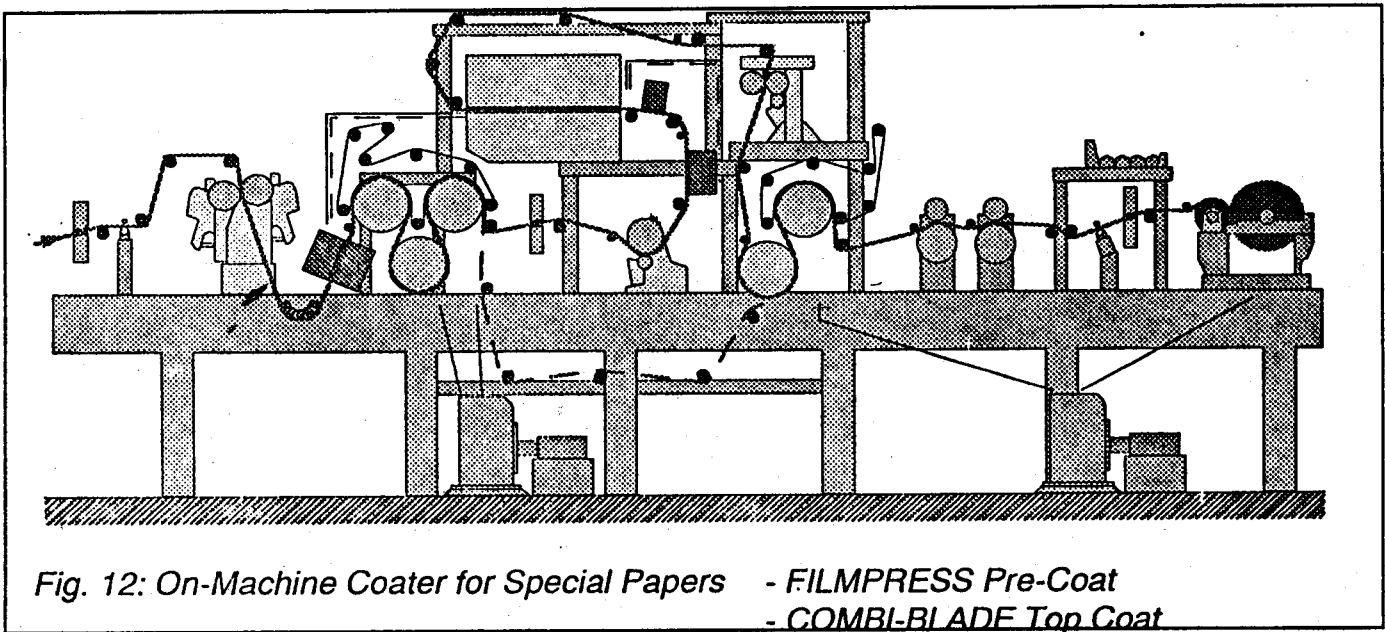
Besides surface-sizing, the application of pigment pre-coats of up to 6 gsm per side is becoming more and more frequent. Despite the accompanying reduction in the coat weight applied off-line, the standard of smoothness, print gloss and coverage is higher.

#### **FILMPRESS FOR PRE-COATING ONE-SIDE-COATED SPECIAL PAPERS**

A paper machine of 4800 mm working width equipped with a Yankee cylinder and followed by an off-machine coater of the same width was used for manufacturing one-side-coated special papers for gift wrapping, packaging, labels etc.

Since the off-line coater handled base paper from various paper machines and was at full capacity, the only way to achieve an affordable increase





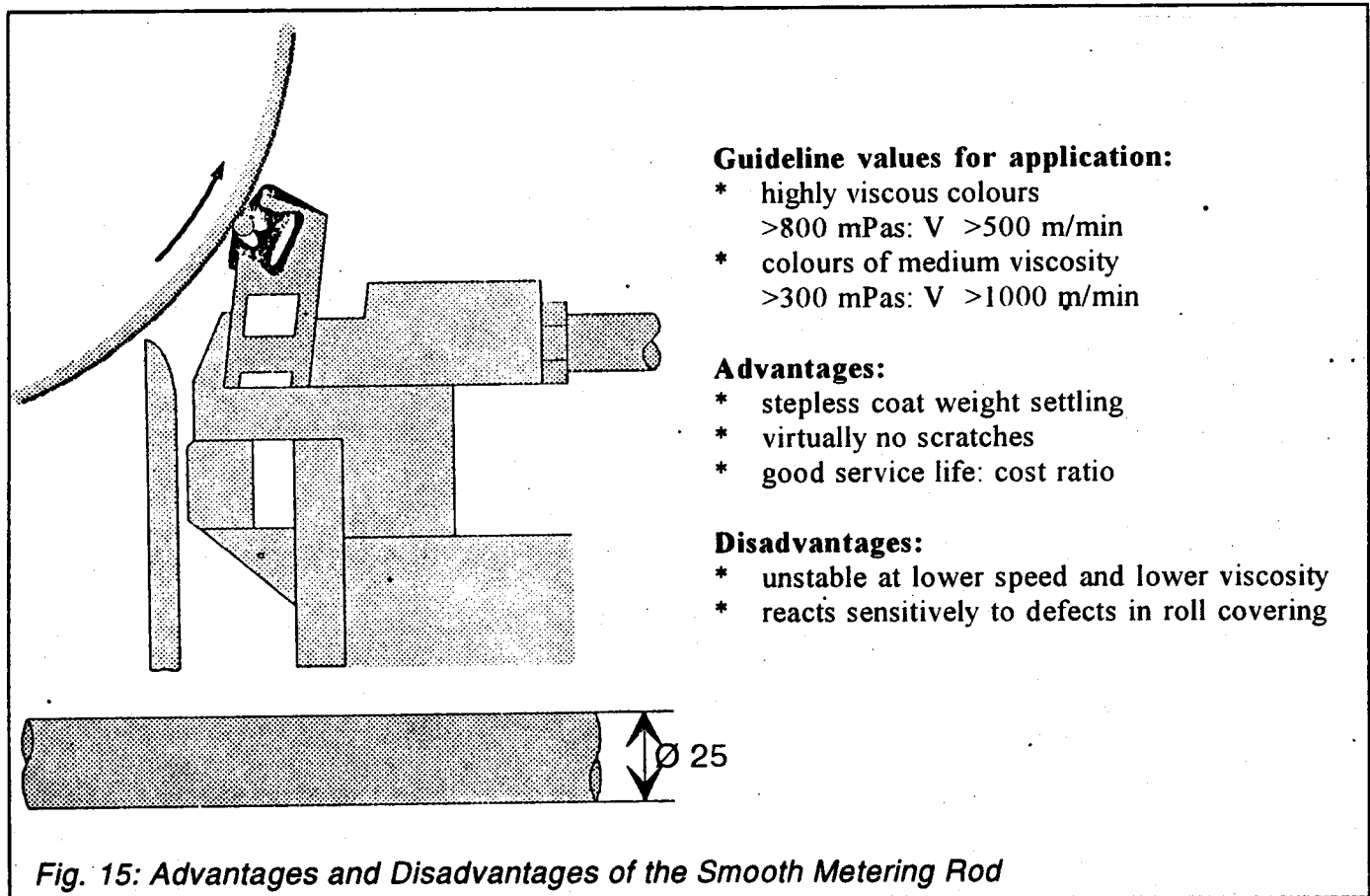
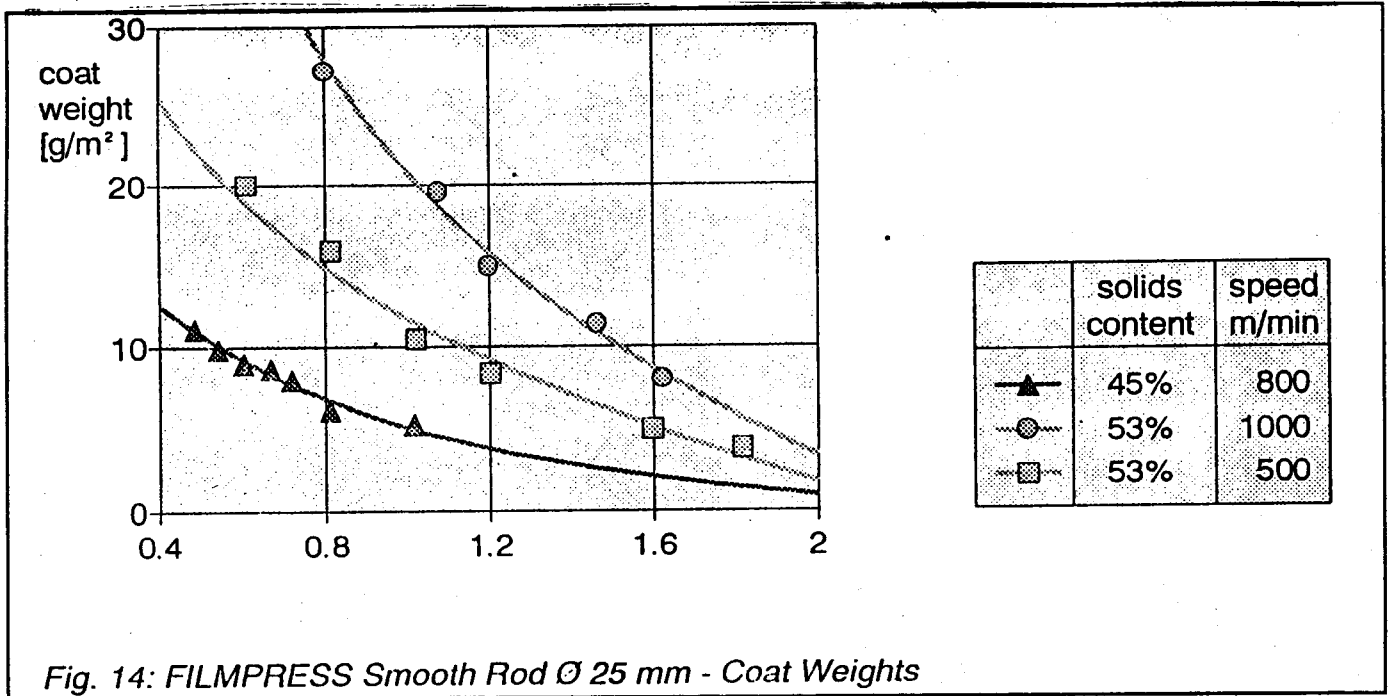
in capacity was to install a coater in the paper machine.

The off-machine coater comprised four coating heads, which could also be used to apply a double coat on one side. The new on-line coater was to be arranged to perform the same with simultaneous reverse-side treatment for optimal flat lay.

The coating concept which was finally realized (Fig. 12) satisfied all these demands!

The side of the paper smoothed with the Yankee cylinder (wire side) is pre-coated with the FILMPRESS with simultaneous reverse-side treatment with water or a starch solution. Either profiled rods or smooth rods of various diameters may be used for metering (Fig. 13).

Like the bent blade, the smooth rod of larger diameter also works on the hydro-dynamic principle (Fig. 14). With selection of the optimum roll covering, the coat weight may be set steplessly.



(Fig. 15) There are no scratches, and the price to service life ratio of the metering rods is also favourable. One disadvantage of the system is possible

instability of the coat profile at lower viscosity and speeds. Defects in the roll covering can also negatively influence coat distribution.

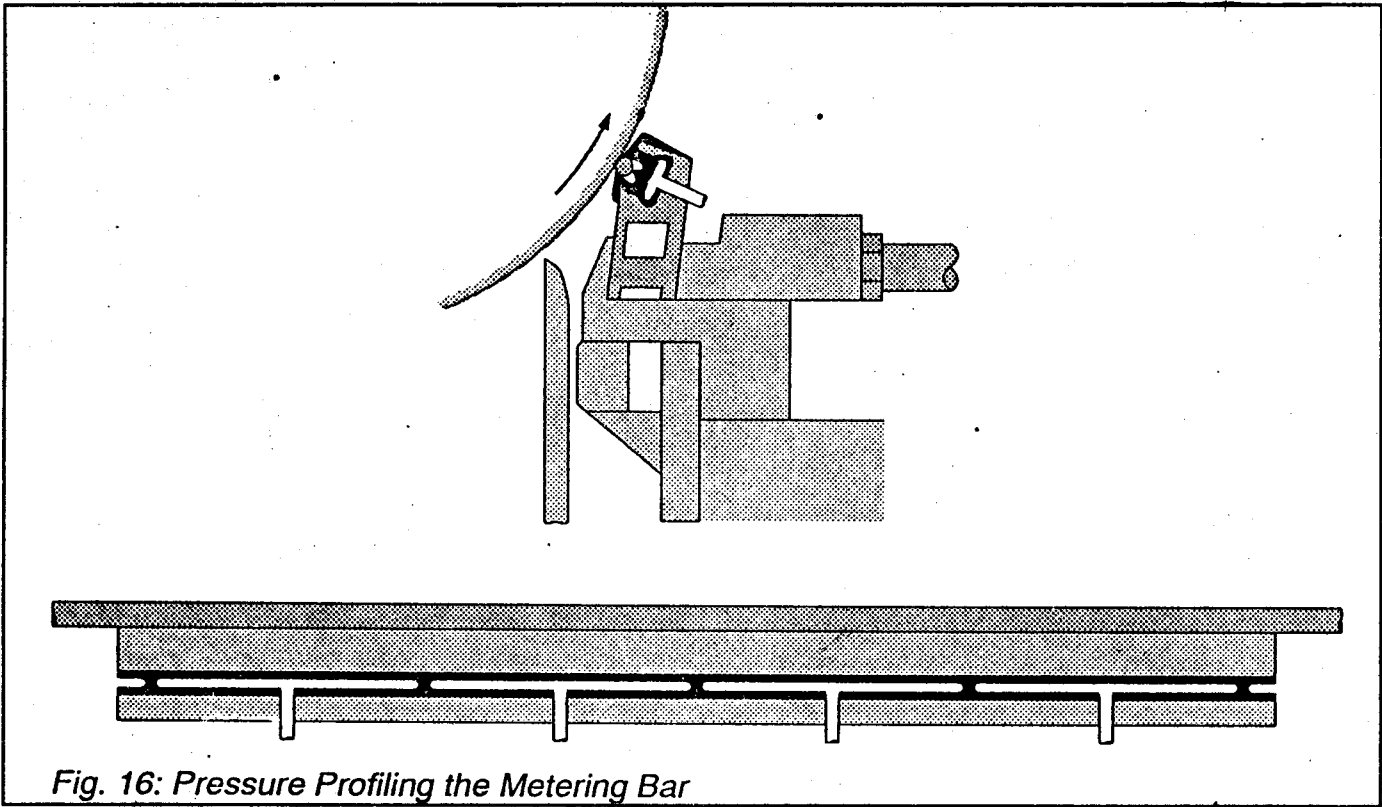


Fig. 16: Pressure Profiling the Metering Bar

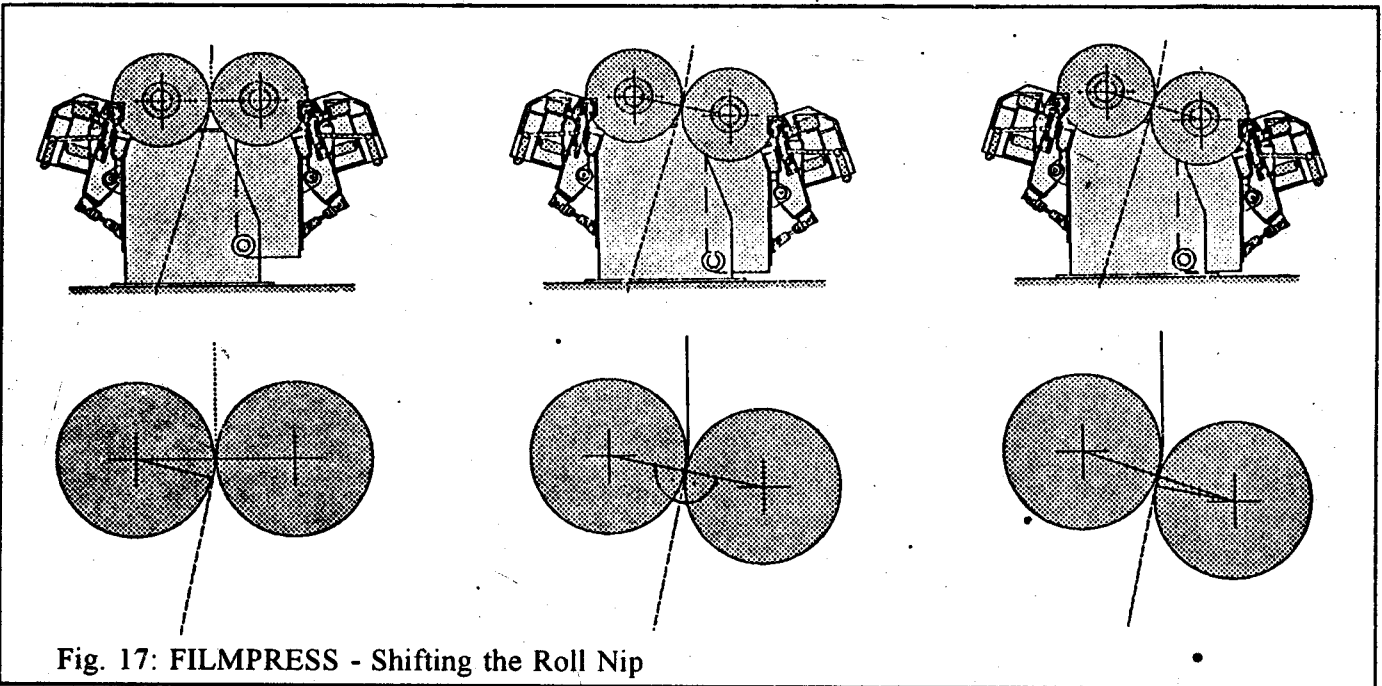


Fig. 17: FILMPRESS - Shifting the Roll Nip

For better control of the cross-profile, a special profiling hose was developed to support the metering rod (Fig. 16).

The pneumatic hose, which is a well-known feature of the VARI-BAR system, was divided into chambers across the working width. These

chambers can be pressurized individually at different levels. In this way, the effect of the metering rod across the working width can be modulated via the hose setting. When a paper exhibits irregular absorption capacity, for example, varying coat weights can be applied to the roll

surface.

A further development was the improvement of the web run at the roll nip exit side on the FILMPRESS (Fig.17):

Depending on the coating medium, it can be observed that before it runs free, the web tends to rest against either the left-hand or right-hand FILMPRESS roll as it leaves the roll nip. The pivoting transfer roll was therefore re-designed with a vertical shifting facility so that the roll position and thus the roll nip could be adapted to the web movement which is expected under certain production conditions. By modifying the position of the rolls, web movement around the rolls is made subject not only to adhesion forces, but also to roll geometry. This facilitates a stable web run following the nip without unwanted web fluttering or surface picking.

Coming back to coater layout, an airtum combined with a load cell for drive regulation is installed following the FILMPRESS pre-coat with simultaneous reverse-side treatment. Gas infrared radiators are also arrangement ahead of the following cylinder group.

A COMBI-BLADE then follows for the top coat. After drying with infrared radiators and an airfloat dryer, a roll-type moistening unit is installed for reverse-side treatment.

A calender with two nips is then available for finishing.

With this investment, the customer not only increased his coated paper capacity, but also generally improved economic efficiency in the production of these special papers.