twogether

Paper Technology Journal

Triple Star – A picturebook startup in Gratkorn.

Brilliant two-sided coating at 2000 metres per minute.

News from the Divisions: Winding technology for the next millennium.

International Paper Technology: Tissue on the upsurge.

Paper Culture: Ludwigslust palace – waste paper recycling of a different kind.

5

Cover picture: PM 11 at KNP LEYKAM in Gratkorn, Austria, the world's most efficient plant for the production of high-grade wood-free coated paper with basis weights of up to 170 g/m².

The plant's overall conception – PM 11, Coater 11, calendering and winding technology – is well ahead of its time. The new reel dimensions with 3.6 meters in diameter and 120 metric tons or more in weight are impressive too. *See articles on pages 8 and 44.*

Contents

Stock Preparation
Graphic Paper Machines
Board and Packaging Paper Machines
Finishing
Service

TOP 5 ONE TEAM

Hans Müller,
President and CEO
Voith Sulzer Papiertechnik

Dear customers, dear readers!

To take the lead in quality, thanks to top technology, innovative methods and excellent service! This was the vision when Voith Sulzer Papiertechnik was created. Unique in this trade, its corporate structure, with five independently operating divisions, is oriented towards this target. The company's comprehensive product range is unique too: the entire technical equipment required by the paper and board industry, ranging from woodyard handling to packaging logistics for the final paper product. Top 5, one team, with everything from a single supplier.

Since its establishment, Voith Sulzer Papiertechnik has succeeded in boosting its turnover by more than 25 percent – after adjustments for acquisitions – within only three years. This is convincing confirmation of the wide acceptance of our objectives and our company philosophy: to be a partner to the paper industry with efficient methods and a competitive edge.

In this issue of twogether magazine you will find three interesting examples of how our top technology enhances quality, efficiency and competitiveness: Gratkorn, the world's most advanced plant for the production of high-grade printing papers; Brilliant Coating, the state-of-the-art test plant for innovative coating technology, and Dagang, two large plants for the production of photocopy, writing and printing paper for the Chinese market. In addition, you will again find numerous innovative system components presented here, with examples of their performance and contributions from the research and development areas. These have turned our customers' magazine into a popular technical journal with a worldwide readership.

I hope you enjoy reading your magazine and discover many interesting ideas within its pages.

Sincerely yours,

Hans Müller

The managers of Voith Sulzer Papiertechnik on the current situation

"Voith Sulzer Stock Preparation is currently the world's leading supplier of paper recycling plants. Thanks to strategic alliances it is also the only supplier which covers the full product range from raw material storage to the papermaking machine, including all peripheral equipment. This number-one position spurs us on to offer customers the latest innovations and technologies. Our efforts are backed by two large research centers in the USA and in Germany. Today, more than 65 % of incoming orders are for machinery and systems of a kind that did not exist until four years ago, when Voith and Sulzer merged their businesses. This innovative synergy represents a good basis for the future – both for our customers and ourselves."

Dr. Lothar Pfalzer
Stock Preparation Division

"By means of market-oriented product development we have strengthened and expanded our leading position in all areas of papermaking machinery technology. Pioneering innovations have been introduced to the market successfully. Thanks to this excellent basis and a positive trend in Asia's growth markets, incoming orders for graphic paper machinery have substantially exceeded the previous year's figures. In the mature markets of the industrial world we were able to secure interesting orders for the modernization of existing production facilities. For the future too, we consider that there is considerable potential in modernization work aimed at improving quality and efficiency. We are prepared to develop this potential together with you – our customers – and to support you in your efforts to produce your paper product in an improved and more efficient way."

Dr. Hans-Peter Sollinger
Paper Machine Division
Graphic

"The consumption of board and packaging paper is strongly correlated with economic growth. New production capacities will therefore be required in particular in the countries of South East Asia. Western countries put an increasing emphasis on projects for enhancing the efficiency and quality of existing plants.

Our research and development activities and the extension of our sales operations as well as cooperation with our joint ventures in China and Russia ensure optimum implementation of the investment targets of our customers."

Prof. Dr. Franz Silbermayr
Paper Machine Division
Board and Packaging

"Thanks to the introduction by the Finishing Division of its Janus and Ecosoft machines, graphic papers in particular now display even more excellent surface properties. Considerably improved optical surface values are expected to be achieved, especially in the field of SC papers, by the imminent introduction of new machines. In addition to the surface, the further processing of all paper and board grades needs fundamental revision too. In this area, we have again trodden new paths with the introduction of Twister and Torowinder (reel cutting machines). Only with technical/technological innovations will we be able to safeguard Germany as an industrial base. The needs and requirements of our customers, who are involved at an early stage, are always at the focal point of our efforts."

Dr. Dieter Kurth
Finishing Division

"Customer Support – For us this means treating our customers as true partners, delivering to them an ever-growing range of products and services. Our primary goal is to offer these value-added benefits in the fastest and most flexible way possible. In order to convert our goals into meaningful actions, we realize that we must also provide facilities which are as geographically close to our customers as possible. That is why we already operate more Service Centers around the world than any of our competitors. However, to continue to exceed our customers' expectations, we must continue to grow. We are doing so with new Service Centers in Brazil, and the U.S., and plans for more in the Far East and Europe. No matter how many locations we may have, it is essential that we continue to view the Service Division from the same perspective as our customer – «the only Service Center I care about is the one nearest my mill.» We must continue to be for our customers a responsible and reliable local partner, ensuring their competitive position in this great industry."

R. Ray Hall
Service Division

"Since Voith Sulzer Papiertechnik was established, we have tried to concentrate our joint capability areas and expertise in paper technology to support our customers in their longing for economic success. Given this target, we are fully aware of the need for continuous improvement.

Only if we succeed in boosting our customers' own success as a result of our commitment and cooperation can we claim that we have accomplished this task.

On the basis of the results achieved so far, we are confident that this unremitting challenge can be accepted, and determined to supply our customers with the partnership and assistance they need."

Dr. Hermann Jung
Finance and Controlling

HIGHLIGHTS

Startup highlights in 1996/97

Stock preparation

Waste paper processing systems and subsystems for graphic papers
Georgia-Pacific Corporation, Kalamazoo, Michigan, USA.
Papresa, Spain.
Stora Hylte AB, Hyltebruk, Sweden.
Papierfabrik Palm GmbH & Co., Eltmann, Germany.
Cartiere Burgo S.p.A., Verzuolo, Italy.
Sepoong Co. Ltd., Sepoong, South Korea.
Cartiere Burgo S.p.A., Mantova, Italy.
Hansol Paper Co. Ltd., Chonju, South Korea.
Australian Paper, Fairfield, Australia.
Schwäbische Zellstoff AG, Ehingen, Germany.
Halla Pulp and Paper Co. Ltd., South Korea.
Daehan Paper Co. Ltd., South Korea.
Steinbeis Temming Papier GmbH & Co., Glückstadt, Germany.
Holzstoff- und Papierfabrik Zwingen AG, Zwingen, Switzerland.
Haindl Papier Schwedt GmbH, Schwedt, Germany.

Waste paper processing systems and subsystems for board and packaging papers
Port Townsend Paper Corporation, Port Townsend, Washington, USA.
Simplex Industries, Constantine, Michigan, USA.
Saica, Spain.
Papelera del Nevado, Mexico.
P. T. Indah Kiat Pulp and Paper Corp., Indonesia.
Knauf, St. Petersburg, Russia.
Papeteries Emin Leydier, St. Vallier, France.
Peterson Moss A.S., Norway.
Rigid Paper Products Ltd., Selby, Great Britain.
Danisco Paper A.S., Grenaa, Denmark.
Europa Carton AG, Hoya, Germany.
Moritz J. Weig GmbH & Co.KG, Mayen, Germany.
Corenso United Oy Ltd., Varkaus, Finland.
Thai Kraft Paper Ind. Co.Ltd., Thailand.
Papierfabrik Meldorf GmbH & Co. KG, Tornesch, Germany.
Papierfabrik Schoellershammer, Düren, Germany.
Klingele Papierwerke GmbH & Co., Weener, Germany
SCA Aschaffenburg, Aschaffenburg, Germany.

Waste paper processing systems and subsystems for tissue papers
Nampak Paper Ltd., Bellville, South Africa.
Carlton Paper Co. of South Africa (Pty) Ltd., Johannesburg, South Africa.
Wepa Papierfabrik, Giershagen, Germany.
P. Krengel GmbH & Co. KG, Arnsberg, Germany.

Waste paper processing systems and subsystems for other types of paper
Munksjö Dekor, Unterkochen, Germany.
Papeteries de Bègles, Bègles, France.
Felix Schöller jr., Burg Gretesch, Germany.
Hunsfos Fabrikker, Vennesla, Norway.

Paper machines

Graphic papers
KNP Leykam, Gratkorn, Austria.
Nippon Paper Industries, Yatsushiro, Japan.
Nippon Paper Industries Co. Ltd., Iwakuni, Japan.
Sinar Mas Pulp and Paper Industries, Sinar Mas, India.
Tianjin No.4 Paper Mill, China.

Board and packaging papers
Mazandaran Wood and Paper Industries, Sari, Iran.
Ningbo Zhonghua Paper Company, Ningbo, China.
Zülpich Papier GmbH, Zülpich, Germany.
VPK Oudegem S.A.N.V., Oudegem, Netherlands.
Visy Paper, Staten Island NJ, USA.

Tissue
Papierfabrik Albert Friedrich, Miltenberg, Germany.
Wepa Papierfabrik, Müschede, Germany.
Strepp GmbH & Co. KG, Kreuzau, Germany.
Thrace Papermill S.A., Greece.
Asia Pulp & Paper, Pindo Dell, Indonesia.
Bacraft S.A., Santo Amaro, Brazil.

Rebuilds
Sczetin Skolwin S.A., Poland.
Alliance Forest Products, Dolbeau, Canada.
Sanku Paper, Fuji, Japan.
Stora Kabel GmbH, Hagen, Germany.
Felix Schoeller Jr. GmbH & Co, Gretesch, Germany.
Haindl Papier GmbH, Walsum, Germany.

Pulp & Paper Corp., Stone
Savannah River, Port Wentworth, USA.
Papierfabrik Palm GmbH & Co., Eltmann, Germany.
Carl Macher GmbH & Co., Brunnenthal, Germany.
Mondi Kraft Piet Retief Mill, South Africa.
Zadklady Celulozy i Papieru S.A., Swiecie, Poland.
Cartiere Fedrigoni & Co., S.p.A., Arco, Italy.
Cartiera di Cadidavid S.r.l., Verona, Italy.
Kitakami Seishi KK, Ichinoseki, Japan.
Takasaki Paper MFG Co. Ltd., Osaka, Japan.
American Israelian Paper Mills, Hadera, Israel.
Montreal, Canada.
Ambro S.A., Suceava, Rumania.
Assi Domän Scaerblacka AB, Scaerblacka, Sweden.
Stora Carton & Board GmbH, Baienfurt, Germany.
Fritz Peters GmbH & Co KG, Gelsenkirchen, Germany.
Patria Papier- und Zellstoff AG, Frantschach, Austria.
Hiang Seng Fibre Container Co. Ltd., Bangkok, Thailand.
Korsnäs AB, Gävle, Sweden.
Aylesford Newsprint, Aylesford, Great Britain.
PWA, Stockstadt, Germany.
Papierfabrik Mochenwangen, Mochenwangen, Germany.
Europa Carton AG, Hoya, Germany.
Papierfabrik Doetinchem B.V., Netherlands.
Smith, Stone & Knight Ltd., Birmingham, Great Britain.
Sappi Europe, Blackburn, Great Britain.
SCA Packaging de Hoop, Netherlands.
Assi Domän Carton AB, Frövi, Sweden.
Liaoning Intern. Trade Corp. Liaoyang, China.
Toprak Kagit Sanayii A.S., Toprak, Turkey.
Hapa Verwaltungs AG, Hallein, Austria.
Asia Pulp & Paper Co. Ltd., Dagang, Singapore.
Pisa Papel-Imprensa SA, Jaguariaiva, Brazil.
Fernandez SA Industria de Papel, Amparo, Brazil.
Papel Prensa SA, Buenos Aires, Argentina.
Westvaco Corp., Luke, USA.
Appleton Papers, West Caroltown, USA.
Longview Fibre Co., Longview, USA.
Torras Domenech, Spain.
Torras Sarrio, Spain.
Saica, Spain.
Mitsubishi Paper Corp., Hachinohe, Japan.
SCA Finepaper, Hallein, Austria.
Chuetsu Pulp Corp., Nohmachi, Japan.
Jujo Paper Board Tokyo Mill, Japan.
Oji Paper Co., Ltd., Kushiro, Japan.
Ziegler Papier AG, Grellingen, Switzerland.
Votorantim Cellulose e Papel S.A., Piracicaba, Brazil.
Crown van Gelder Papierfabriken, Holland.
Genting Sanyen Ind. Paper, Malaysia.
SCA Wifsta-Östrand, Sweden.

Coating technology
SCA Fine Paper, Hallein, Austria.
Haindl, Walsum, Germany.
Tianjin Paper, Tianijn, China.
Westvaco Corp., Wickliffe, USA.
KNP Leykam, Gratkorn, Austria.
Felix Schöller jun. Papierfabriken GmbH & Co KG, Osnabrück, Germany.
Guanzhou Victorgo Ind. Comp. Ltd.
Shin Ho Paper Mfg. Co. Ltd., Seoul, Korea.
Stora Hillegossen, Germany.
Consolidated Paper, USA.
Champion International Corp., USA.
Kombassan Holding, Murathi, Turkey.
Mead Corporation, USA.
Assi Domän Carton AB, Frövi, Sweden.
Burgo, Sora, Italy.
Brilliant Coating Pilot SM 2, Heidenheim, Germany.
Valchiampo Paper Mill, Italy.
Sarego Paper Mill, Italy.
Champion, Quinnesec, USA.
Mead Chillicothe, USA.

Winding technology
– DuoReel
Forestiers Alliance Inc., Dolbeau, Canada.
August Koehler AG, Oberkirch, Germany.
Shin Ho, Daejeon, Korea.
Pratt Industries Inc., USA.
Hermanecke Papierne akciova spolocnost, Poland.
Bacraft S.A. Industria de Papel, Brazil.
Mazandaran Wood and Paper Industries, Sari, Iran.
Zadklady Celulozy i Papiern S.A., Swiecie, Poland.

– Sirius/Sirius rewinder
KNP Leykam, Gratkorn, Austria.

– Winders
Consolidated Papers Inc., Wisconsin, USA.
Fabryka Papiern Szczecin-Skolwin S.A., Poland.

Finishing

Janus Concept
KNP Leykam, Holland.
KNP Leykam, Austria.
Gebr. Lang, Germany.
Shin Ho, Daejeon, Korea.
Oji Paper Co. Ltd., Kushiro, Japan.

Supercalenders
Tianjin, China.
Yuen Foong Yu, Taiwan.

Ecosoft calenders
Halla, Korea.
Forestiers Alliance Inc., Dolbeau, Canada.
Berghulzer, Netherlands.
Appleton Papers, USA.
Sappi, Blackburn, Great Britain.
MNI, Malaysia.
Miliani, Hungary.
Votorantim Piracicaba, Brazil.
Ningbo PM 2, China.
Ningbo PM 3, China.
Cascades La Rochette, France.
Dae Han Paper, Korea.
Maltadecor, Poland.
Suzano Rio Verde, Brazil.
Arjo Wiggins, Great Britain.
Amotfors, Sweden.

Machine calenders
KNP Leykam, Austria.
Ningbo PM 2, China.
Ningbo PM 3, China.
Shin Dae Yang, Korea.
Hwa Seung Paper, Korea.
Ding Il Paper, Korea.

Rebuilds
KNP Leykam, Austria.
Haindl, Walsum, Germany.

Twister
Hankuk, Korea.
Halla, Korea.
Gebr. Lang, Germany.

Roll handling
Halla, Korea.
KNP Leykam, Netherlands.
Scheufelen, Germany.
Gebr. Lang, Germany.
Hankuk, Korea.

HIGHLIGHTS

Recent large orders

Stock preparation

Waste paper processing systems and subsystems for graphic papers
Perlen Papier AG, Perlen, Switzerland.
Papierfabrik Palm GmbH & Co., Eltmann, Germany.
Gebrüder Lang GmbH, Ettringen, Germany.
Steinbeis Temming Papier GmbH & Co, Glückstadt, Germany.
Felix Schoeller jun. GmbH & Co. KG, Gretesch, Germany.
Drewsen GmbH & Co KG, Lachendorf, Germany.
Papierfabrik Palm GmbH & Co., Aalen, Germany.
August Koehler KG, Oberkirch, Germany.
Holzstoff- und Papierfabrik Zwingen AG, Zwingen, Switzerland.
Stora, Corbehem, France.
Norske Skog Golbey S.A., France.
Soporcel Socieda Portugesa de Cellulose S.A., Portugal.
Haindl Papier GmbH, Germany.
Munksjö, Unterkochen, Germany.
Halla Paper Co. Ltd., Korea.
Hansol Paper Co. Ltd., Korea.
Genting Sanyen SDN BHD, Malaysia.
Hunsfos Fabrikker, Vennesla, Norway.
Parenco B.V., Renkum, Holland.
Papelera Peninsular, Spain.
Schoeller & Hoesch, USA.
Bowaters/Great Northern Paper, East Millinocket, USA.
Felix Schoeller, Great Britain.

Waste paper processing systems and subsystems for board and packaging papers
Adolf Jass GmbH & Co KG, Fulda, Germany.
Corenso United Oy Ltd., Varkaus, Finland.
Portucel-Viana Empresa, Portugal.
SCA Packaging, Munksund, Sweden.
Schoellershammer GmbH & Co KG, Osnabrück, Germany.
Smurfit Carton y Paper de Mexico SA de CV, Cerro Gordo, Los Reyes Ixtacala, Mexico.
Willamette Industries, Campti, Lousiana, USA.
Union Camp. Corp. Franklin, Virginia, USA.
Domtar Packaging Ltd., Red Rock, Ontario, Canada.
Zinc National, Monterrey, Mexico.
Cia de Papel do Prado, Portugal.
Saica, Spain.
Europac, Spain.
Genting Sanyen SDN BHD, Malaysia.
Hansol Paper Co. Ltd., Korea.
Dae Han Pulp Ind. Co. Ltd., Korea.

Waste paper processing systems and subsystems for tissue papers
Kimberley Clark GmbH, Flensburg, Germany.
Nampak Paper Ltd., Bellville, South Africa.
Copamex Planta Uruapan, Uruapan, Mexico.
Copamex Planta Tissue Monterrey, Monterrey, Mexico.
Oconto Falls Tissue, Oconto Falls, Wisconsin, USA.
Genting Sanyen SDNBHD, Malaysia.
Dae Han Pulp Ind. Co. Ltd., Korea.

Waste paper processing systems and subsystems for other grades
International Paper Co., Rieglewood, North Carolina, USA.

Paper machines

Graphic papers
Asia Pulp & Paper Co. Ltd, Dagang, China. (2 PM)
Malaysian Newsprint Industries Ltd., Mentakab, Malaysia.
Quena Newsprint Paper Company, Quena, Egypt.
Soporcel-Sociedade Portuguesa de Celulosé S.A., Lavos, Portugal.
China National Technical Import & Export Corp., China.

Board and packaging papers
Modern Karton Sanayi ve Ticaret S.A., Turkey.
Guangzouh Victorgo Industry Co. Ltd., Victorgo, China.

Tissue
Lontar Papyrus, Jambi, Indonesia.
Suzhou (2TM), China.
Hengan, China.
Goma Camps, LaRiba, Spain.
Oconto Falls, USA.

Rebuilds
Stone Container, New Richmond, USA.
Kombassan A.S., Kombassan Turkey.
Lee & Man Paper Manufacturing Co., Ltd., China.
Kartonsan Karton San Tic A.S., Kartonsan, Turkey.
Pakerin Pulp & Paper, Pakerin, Indonesia.
P.T. Lotar Papyrus Pulp & Paper, Indonesia.
P.T. Pindo Deli Pulp & Paper Mills, Indonesia.
Asia Pulp & Paper Co., Ltd., Suzhou, China.
D.D. Umka Fabrika Kartona, Umka, Yugoslavia.
Nippon Paperboard Co., Ltd., Jujo Paper Board, Japan.
Eurocan Pulp & Paper Co., Eurocan-Kitimat, Canada.
Papeteries de l'Aa, Wizernes, France.
Roman Bauernfeind GmbH, Fronleiten, Austria.
E.B. Eddy Forest Products Ltd., Espanola, USA.
Papierfabrik Hermes GmbH, Düsseldorf, Germany.
Wisaforest OY AB, Pietsaari, Finland.
Consolidated Papers Inc., Biron, USA.
Parenco. B.V. Renkum, Netherlands.

Papierfabrik Utzenstorf AG, Utzenstorf, Switzerland.
Adolf Jass, Fulda, Germany.
Hermes, Düsseldorf, Germany.
Arjo Wiggins Papiers & Couches, Wizernes, France.
VPM Kymmene, Wisa Forest, Finland.
Assi Domän Skärblacka AB, Skärblacka, Sweden.
Marackeh Pulp & Paper Industries, Teheran, Iran.
Miguel y Costas, Spain.
Saica, Spain.
Patria Papier & Zellstoff AG, Frantschach.
UIPSA, Spain.
Icec Papcel a.s., Ruzomberok, Czech Republic.
Zinc Nacional S.A., San Nicolas, Mexico.
Westvaco Corp., North Charleston, USA.
Kruger Inc., Montreal, Canada.
LSPI, Duluth, USA.
Fletcher Challenge, Elk Falls, Canada.
Fraser, Madawaska, USA.
Mead Corp., Rumford, USA.
E.B. Eddy Forest Products Ltd., Hull, Canada.
Orsa Fabrica de Papelao Ondulado S.A., Itapeva, Brazil.
Fernandez S.A., Amparo, Brazil.
Klabin Fabricadora de Papel e Celulosa, Piracicaba, Brazil.
Votoranim Celulose e Papel, Votoranim, Luiz Antonio, Brazil.
Inforsa Industrias Forestales S.A., Nascimiento, Chile.
Fraser Paper Ltd., Madawaska, USA.
Nippon Paper Industries, Yatsushiro, Japan.
Nippon Paper Industries, Kushiro, Japan.
Champion Int. Corp., Bucksport, USA.
Consolidated Papers Inc., Duluth, USA.
Cia Manufacturera de Papeles y Cartones S.A., Chile.
Hansol Paper Co., Ltd., Taejeon, Korea.
Munksjö Paper, Fitchburg, USA.
Chuetsu Pulp Co., Japan.
Calpasoro, Spain.

Coating technology
Westvaco Corp. USA.
Mead Corp. Rumford, USA.
Consolidated Paper Corp., Rapids, USA.
Stora Kabel, Germany.
Consolidated Paper Corp., Stevens Point, USA.
Consolidated Paper Corp., Biron, USA.
APP, China.
Intermills, Malmedy, Belgium.
P.T. Pakerin Pulp and Paper, Indonesia.
Modern Karton Sanayi ve Ticaret S.A., Turkey.
Venepal, Venezuela.
Quena Newsprint Paper Company, Quena, Egypt.
Champion Int. Corp., Quinnesec, USA.

Winding technology
– DuoReel
Gold East Paper, Jiangsu, China.
Votorantim Celulose e Papel, Brazil.
Malaysian Newsprint Industries Kuala Lumpur, Malaysia.
Inforsa Industrias Forestales S.A., Nascimiento, Chile.
Klabin Fabricadora de Papele Celulosa, Piracicaba, Brazil.
Votoranim Celulose e Papel, Piracicaba, Brazil.
Votoranim Celulose e Papel, Jacarei, Brazil.

– Winders
Gold East Paper, Jiangsu, China.
Dagang, China.
Gebr. Lang, Germany.

Finishing

Janus Concept
Stora, Port Hawkesbury, Canada.

Supercalender
Daewoo, Korea.

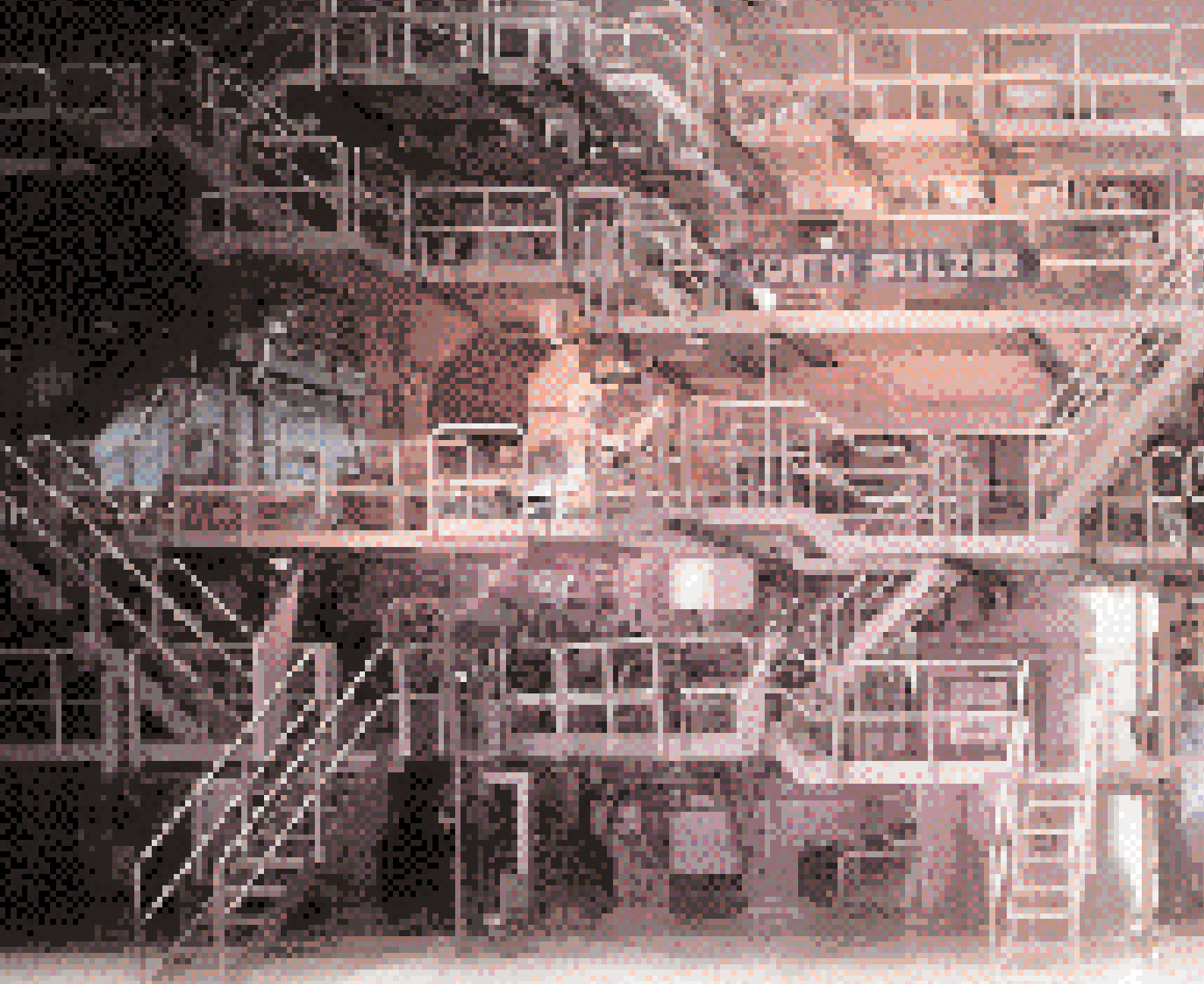
Ecosoft calenders
Alkim, Turkey.
Boading, China.
K.C. Huntsville, USA.
Toprak, Turkey.
Votorantim Jacarel, Brazil.
Nan Ya Plastics, Taiwan.
3 M, Canada.
Munksjö Fitchburg, USA.
Poligraphico, Italy.
Victorgo, China.
Dagang, China
Dow Chemical, Switzerland.
Pap. del Centro, Spain.
Imperial, USA.
Inforsa, Chile.

Machine calenders
Kalamazoo, USA.
Modernkarton, Turkey.

Rebuilds
Millykoski, Finland.
KNP Leykam, Belgium.

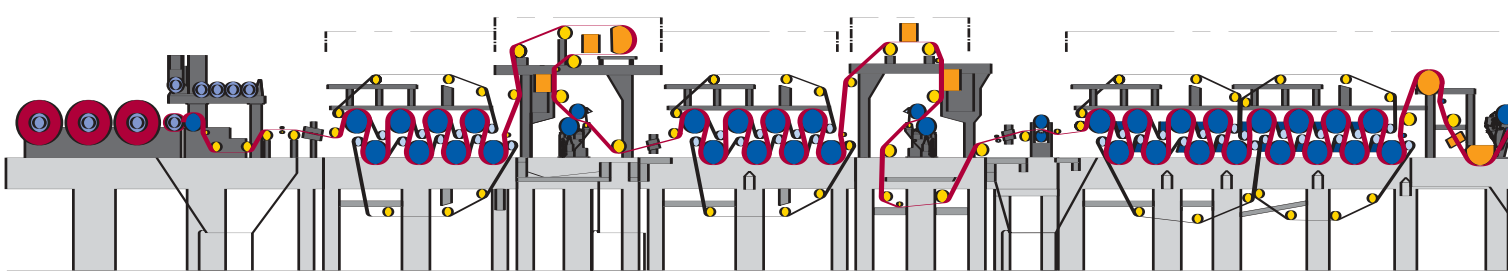
Twister
BPB Davidson, Great Britain.
Pap. Peninsular, Spain.
Koehler, Germany.
Holtzmann, Germany.
Madison, USA.
UPM Walki Wisa, Great Britain.

Roll handling
BPB Davidson, Great Britain.
Burgo Ardennes, Belgium.
MNI, Malaysia.
Biolomatik f. Biberist, Switzerland.
Holtzmann, Germany.



TRIPLE STAR

A Picturebook Startup in Gratkorn, Austria

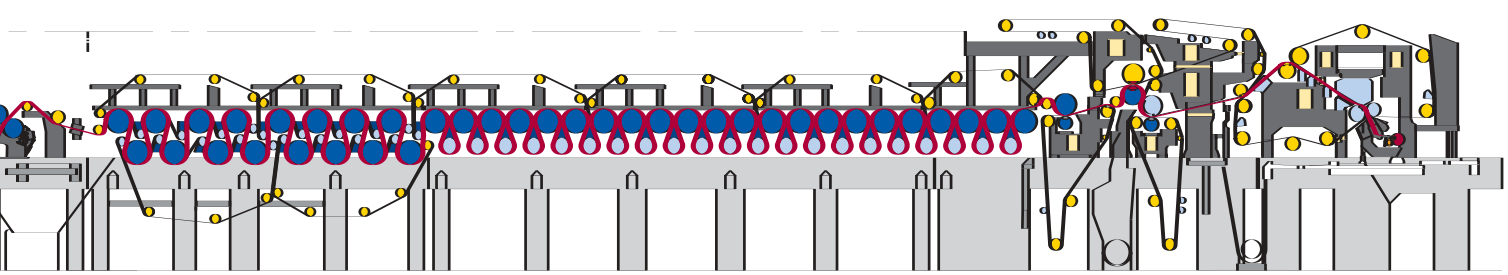


1

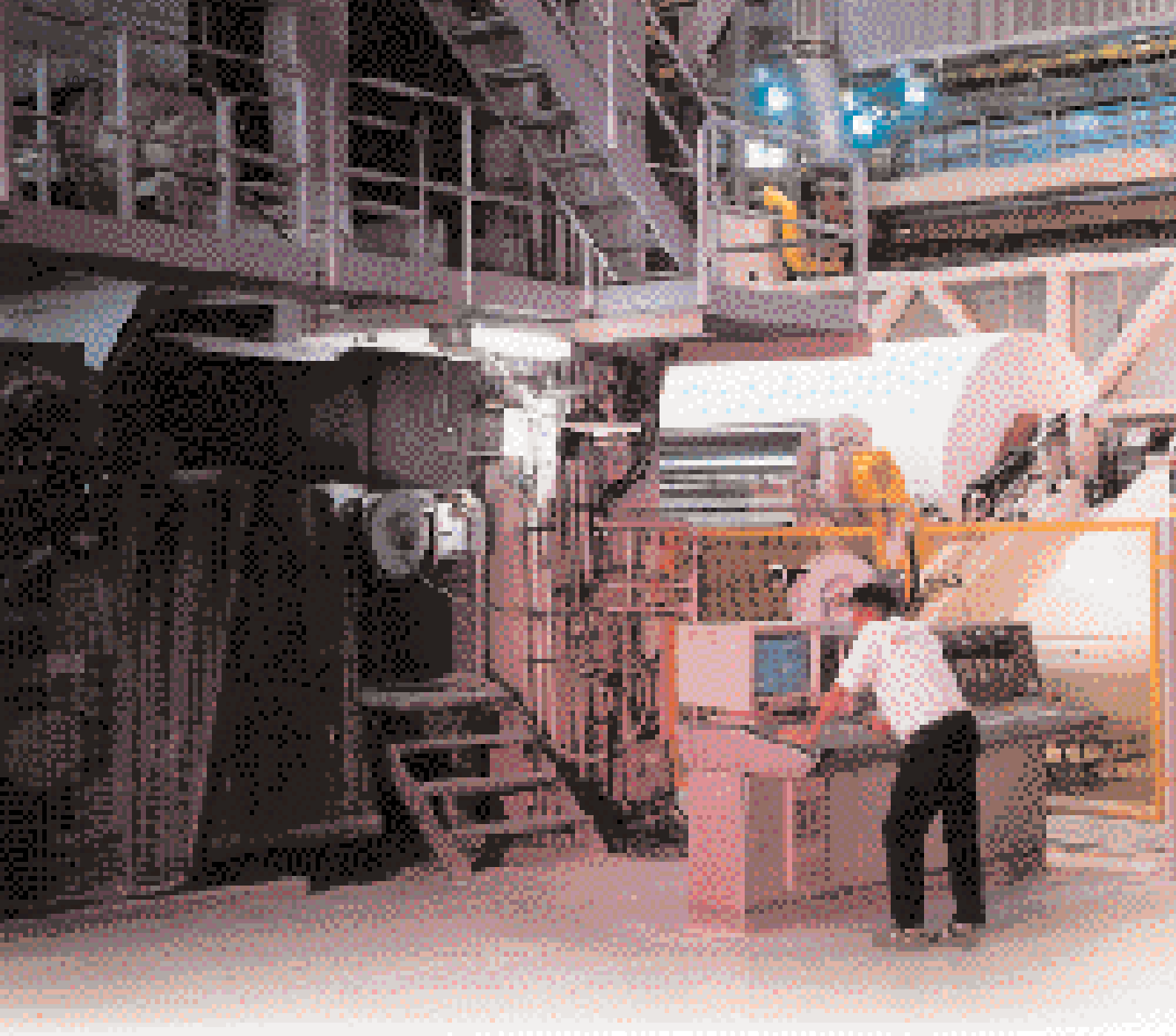
On October 12, 1997 – two weeks early – the world's largest wood-free coated paper production line started up at KNP LEYKAM in Gratkorn, Austria. The paper machinery, coating and calendering machines for this state-of-the-art plant were supplied by Voith Sulzer Paper Technology.

"Thanks to the suppliers' highly trained staff and first-rate cooperation, this startup was absolutely troublefree and one of the fastest on record. Only six weeks afterwards, we already operate at 1100 m/min over long periods", reports production manager Manfred Tiefengruber.

Shortly after startup, this new paper machine (PM 11), designed for speeds up to 1500 m/min, fulfilled all quality criteria including formation, tensile strength, and 2-sidedness of ash content, fines distribution and smoothness. The technological concept was worked out in close collaboration between KNP LEYKAM and all



2



suppliers, and confirmed by exhaustive trials. As a result of this outstanding teamwork, the customer now has an innovation-rich machine capable of producing 470,000 tonnes p.a. of high grade coated paper.

Incorporated in its latest version, the *Module-Jet headbox* ensures a first-class CD basis weight profile which can be controlled independently of fiber orientation profile. And with the *DuoFormer CFD*, all requirements for ash and fines distribution in coated grades are met in full. Furthermore, this Gapformer meets the most exacting formation demands over a very wide speed range. The machine is also equipped with a *NipcoFlex press*, the leading technology in wood-free paper production, which ensures a high dry content with optimally high volume. A combination of single and dual dryer units permits excellent runability with high drying efficiency. Further attractions of this Voith Sulzer paper machine are a Speedsizer and two *Speedcoaters*.

The futuristic *Sirius* winding technology used here represents a world innovation. The main feature of this concept is a mobile Senso pressing roll ensuring directly controllable nip conditions (see report on page 44), which enables faultless winding of the world's largest reels weighing 120 tonnes, with a diameter of 3.6 metres.

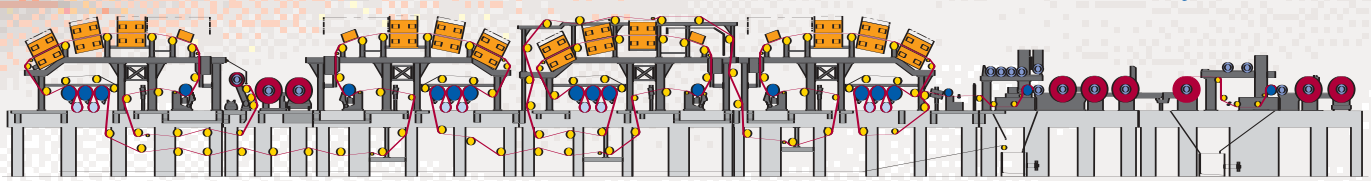
Designed for an operating speed of 1800 m/min, the coating unit comprises four *JetFlow F* coaters, whose outstanding uniformity is ensured by CD profile control. Since the *Sirius* winding concept is likewise used on the coating machine, reeling results are outstanding despite the high smoothness and low porosity of this triple-coated paper.

3

Figs. 1 and 2: Photograph and schematic layout of the new PM 11 in Gratkorn.

Figs. 3 and 4: The SM 11 coating machine (photograph and schematic layout), designed for an operating speed of 1800 m/min.

Fig. 5: The triumphant KNP-LEYKAM project team in Gratkorn: K. Merzeder (left), Dr. D. Radner and M. Tiefengruber.



4

This consistent use of the latest technology was followed up by installing two *Janus calenders*. With higher steel roll surface temperatures and polymer covers, this results in a paper surface with extremely low porosity and high gloss.

With all these innovations, the ***Triple Star*** is indeed a concept of superlatives – a true quantum leap into the next millennium!

The author:
Marion Nager, Corporate Marketing VSPT, interviewed production manager Manfred Tiefengruber, KNP-LEYKAM Gratkorn.

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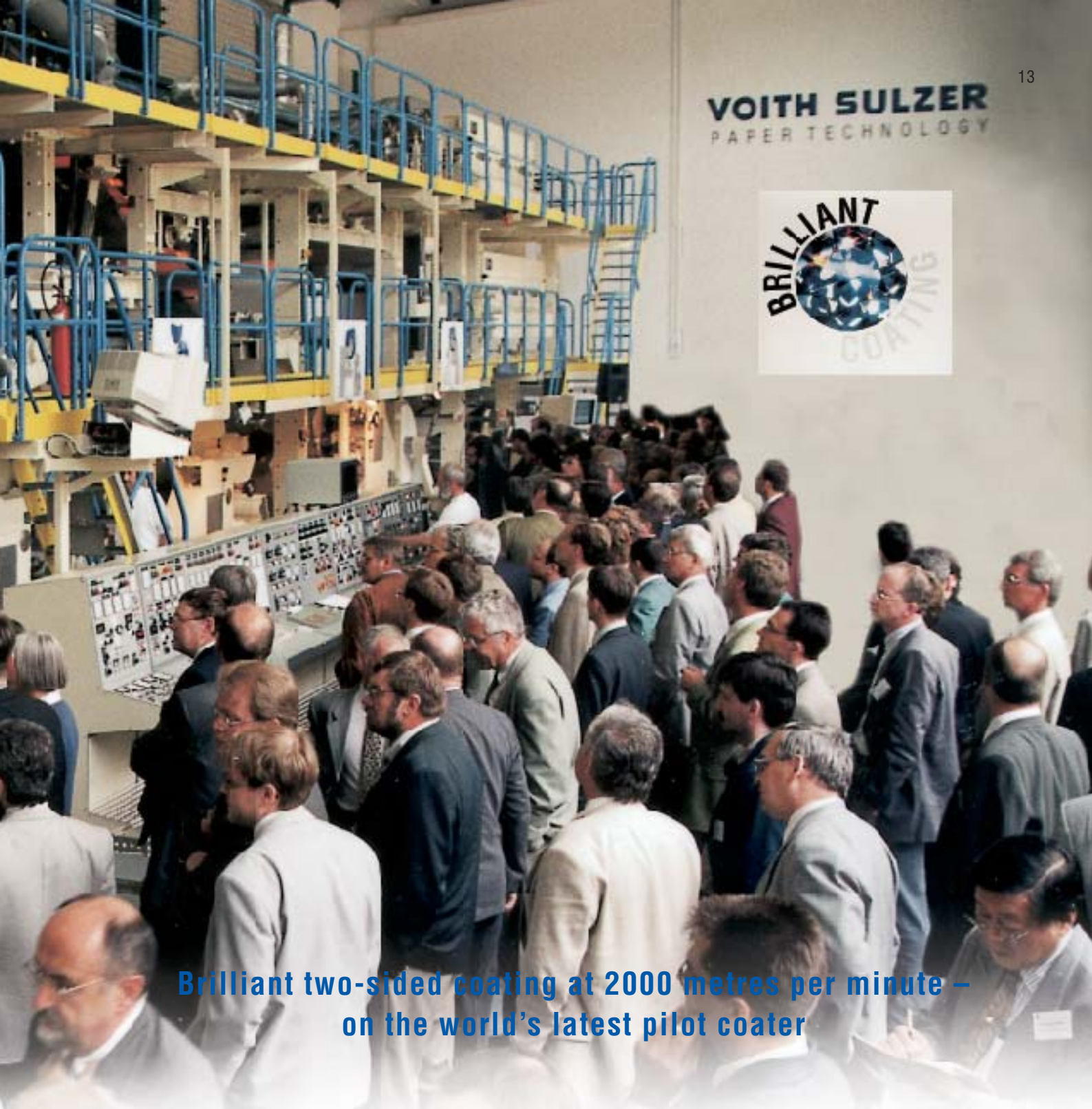

Brilliant two-sided coating at 2000 metres per minute – on the world's latest pilot coater

Brilliant Coating was the theme of a big event last summer: the inauguration of Voith Sulzer Paper Technology's new pilot coater. Voith Sulzer Papiermaschinen GmbH invited coating specialists from all over the world to this historical occasion – and some 200 of them arrived in Heidenheim on June 4 and 5, 1997 from Europe, Asia, South Africa and the USA.

This gala party started the first evening, with fireworks and a genuine Samba group flown in by our Brazilian people. A good many interesting discussions got underway here between old friends and new, so that by the next day everyone was well tuned in for six papers on "Brilliant Coating Technology Today and Tomorrow". Then came the actual christening ceremony: a world premiere with 2-sided LWC paper coating in a single throughput – at 2000 metres per minute!

Our Brilliant Coating event was opened by Dr. Hans-Peter Sollinger, CEO Voith Sulzer Papiermaschinen GmbH. He drew attention to the increasingly important role of coating technology today, not only for new installations but also for existing machinery. Through systematic upgrad-

Guests were welcomed by Dr. Hans-Peter Sollinger, CEO Voith Sulzer Papiermaschinen GmbH, Heidenheim.

ing, the latter can hold their own very well against tough international competition both now and in future – thanks to ongoing innovations by Voith Sulzer Paper Technology.

That is why Voith Sulzer Paper Technology maintains a modern "fleet" of test facilities, including this high-tech coating machine on which customer tests are also carried out. Last year it was again upgraded to the latest state of technology, thus ensuring optimal testing facilities for our paper industry customers.

To this purpose the existing No. 1 machine was extended to form machine No. 2, which can operate at speeds up to 2500 m/min *(Fig. 1)*.

With both machines together, Voith Sulzer Paper Technology now has a test facility which is unique worldwide: paper can be coated simultaneously on both sides in a single throughput at speeds up to 2000 m/min – which not only saves an enormous amount of testing time, but also makes coating quality much more realistic.

Here is a summary of the papers given under the general title "Brilliant Coating Technology Today and Tomorrow":

World Market Analysis for Coated Paper, and The Voith Sulzer Paper Technology Center Of Competence

Coating technology manager *Dr. Rüdiger Kurtz* started off by presenting a world market analysis for coated paper, including a tour of the Heidenheim coating division. He pointed out that Voith Sulzer Paper Technology coating technology specialists are not only to be found here, but all over the world at our various centres – for example in Appleton USA, Sankt Pölten in Austria, and São Paulo in Brazil.

Market Analysis for Coated Paper, and The Voith Sulzer Paper Technology Center Of Competence

The world market for coated paper is growing relatively quickly, at the same time demanding high value-added against tough competition *(Fig. 2)*. Nevertheless, market needs and production capacity are not always well balanced. *Fig. 3* and furthermore subject to fluctuations and recession cycles typical of the consumer goods industry *(Fig. 4)*.

Currently the market is dominated by large American, Scandinavian and Asian corporations in ongoing competition against each other for technological leadership. The size and speed of coating machines have thus increased dramatically *(Fig. 5)*, and with higher production rates the worldwide consumption of coating pigments and chemical additives is

A feast indeed, to delight the eyes and whet the intellect… with brilliant coating and papers alike, innovative technology – and Samba dancing as "hands across the ocean" from VSPT Brazil.

Round-table discussions followed by first-rate presentations the next day – an excellent way of keeping up with a fast-moving technology.

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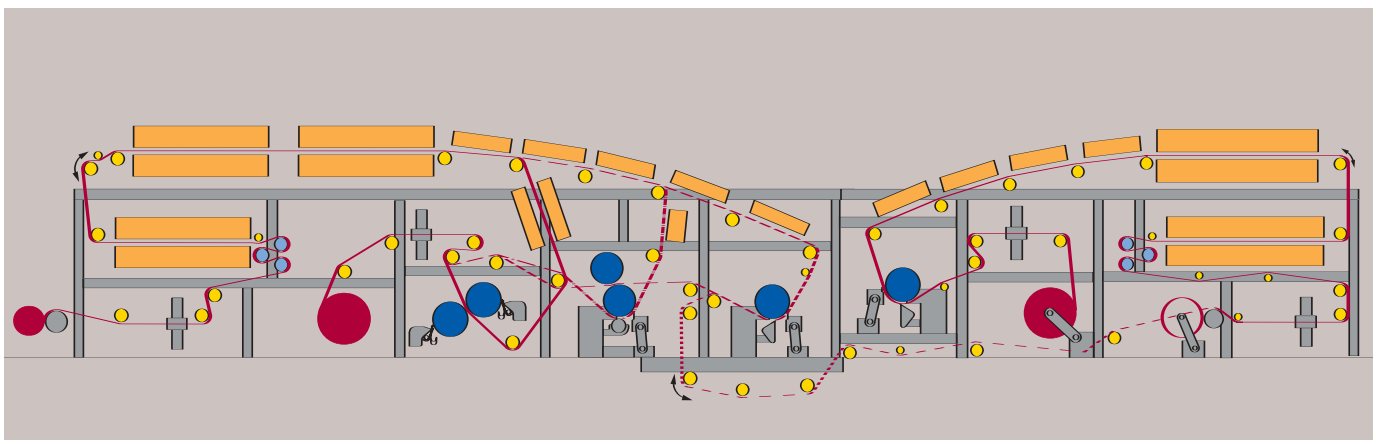

Fig. 1: Pilot Coater
4 Coater stations
Maximum Speed 2500 m/min
Automatic Tension Control
Diameter of rolls 1000 mm
Paper width 800 mm
Maximum reel diameter 1500 mm
Core Size 3'' and 6''

also rising *(Fig. 6)*. Due to the trend in papermaking toward chemically neutral processing and new coating methods, for example, calcium carbonate consumption has grown enormously and new ways of enhancing coating quality have arisen.

Analysis reveals a clearly positive paper market trend into the next millennium. Potential consumption and growth figures are promising not only for the emerging markets of Asia and Eastern Europe, but also for the traditional papermaking regions of Western Europe and North America. Demands on paper quality have risen enormously, however, so that new technologies are indispensable. This means that special attention has to be paid to upgrading and modernization, in order to meet these demands with existing machines as well as new ones.

The market share of Voith Sulzer Coating Technology in machinery deliveries averaged about 19% over the last eight years *(Fig. 7)*, and our goal is to increase this share through product innovations. With regard to coated board, for example, we are treading new paths to eliminate the drawbacks of conventional methods such as air-knife coating. By upgrading the board coating machine at Assi Domän in Frövilors to this new concept, we are already well on the way. Only by looking to the future with mature technology and well-founded innovations, can paper and

Fig. 2: Annual Market Growth of Paper Consumption. Worldwide 1993-2010.

Fig. 3: Supply/Demand Balance 1991-1998.

Fig. 4: Real (inflation adjusted) Prices/Tonnes (Value). Printing/Writing Paper Demand – Worldwide.

Fig. 5: Trends for Off-line Coaters.

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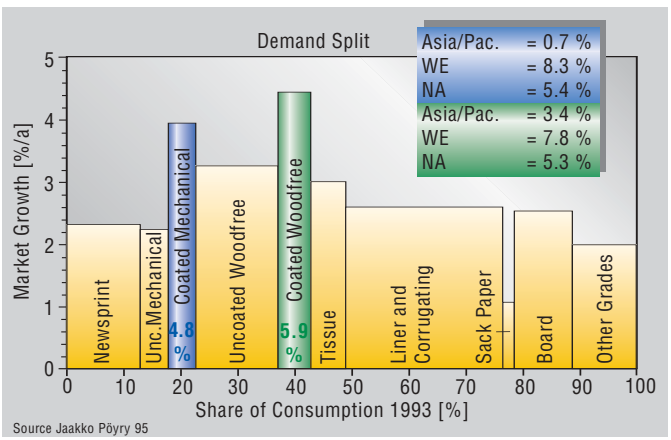

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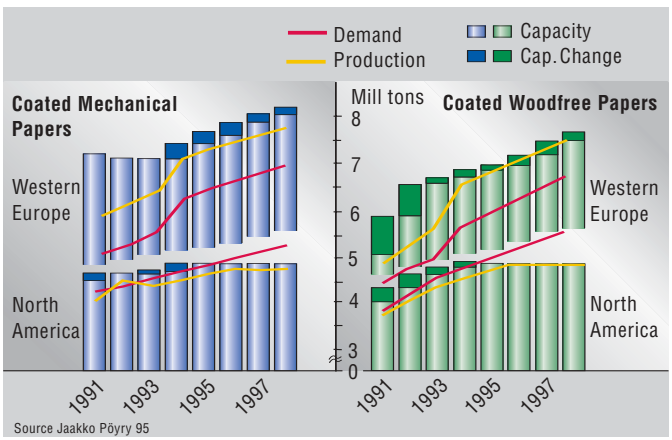

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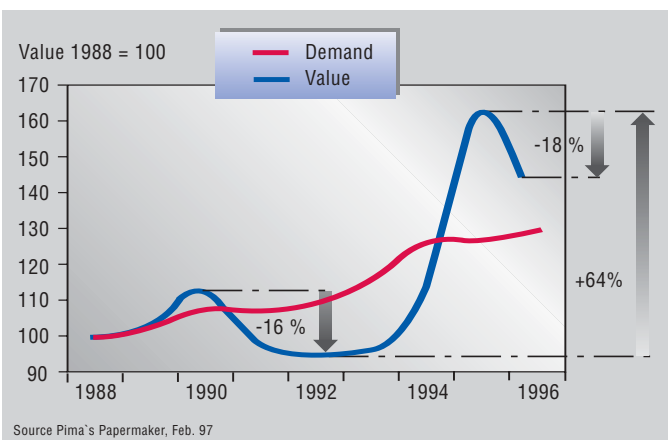

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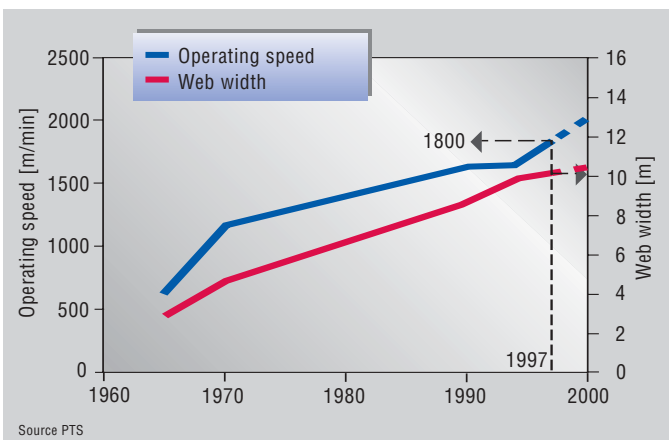

coating machines be built such as the new KNP-Leykam line. This produces 470,000 tonnes p.a. of high quality triple-coated wood-free paper, 9 metres wide at a speed of 1400 m/min. Both coating systems used in this line – film coating and jet/blade coating – are based on years of development work by Voith Sulzer. Our greatest strength lies in the comprehensive papermaking know-how we have accumulated "twogether", ranging from raw materials, stock preparation and paper machinery to coating and finishing. As impressively demonstrated at KNP-Leykam, this is particularly reflected in our on-line concepts.

Every year Voith Sulzer Paper Technology invests substantial sums in research and development. Our new coating test facility *(Fig. 1)* is good example of how well this investment pays off, and it is entirely at the disposal of our customers. We hope you will make the most of this new facility to profit from our brilliant coating technology.

Production Experience with the JetFlow F

Bernhard Kohl, technical marketing and project manager, reported on production experience with the JetFlow F introduced a few years ago by VSPT as the world's first jet coater. Since then the JetFlow F has established itself as state-of-the-art for practically all paper grades and operating speeds from 150 to 2000 m/min.

Fig. 6: Consumption of Coating Pigments in Western Europe.
Fig. 7: Market Share for Coated Paper (1988-1995).

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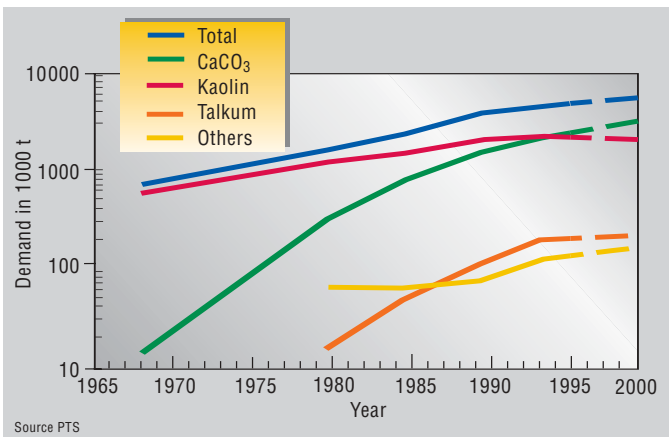

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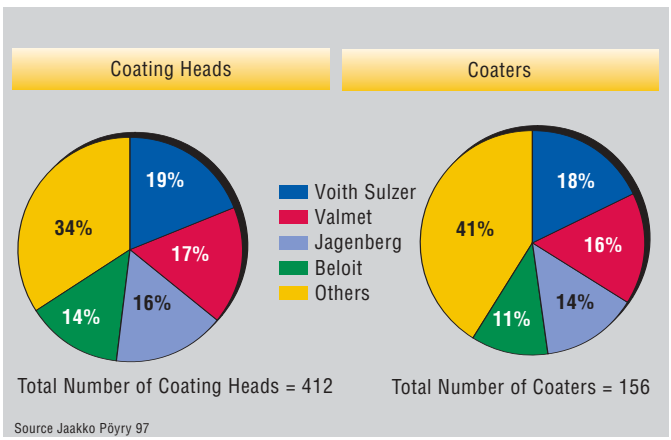

By June 1997, there were already fourteen JetFlow F coaters in operation both in online and offline machines. Experience has shown that in all cases, the mills concerned reap substantial benefits:

- Production increases averaging six percent, since higher speeds can be run without affecting quality.
- Far fewer web ruptures.
- Much shorter setup times.
- Higher coating solids content and reduction of co-binders accordingly.
- Higher quality coating at higher speeds.
- No more coating errors (stiffness).
- Less thickening on the coater.
- Lower drive power consumption.

The cost-effectiveness of the JetFlow F is impressively illustrated by payback times ranging from 10 to no more than 22 months (depending on application).

The Speedcoater – Quality and Economy

Harald Hess (Coating Technology) gave an interesting paper on the Voith Sulzer Speedcoater.

The sizing, pigmenting and coating applications of this film coater extend up to densities of 15 g/m^2 per side, with high solids content. Furthermore, the Speedcoater covers an extremely wide variety of grades, ranging from wood-containing and wood-free printing/writing papers to special papers and board.

Advantages of the Speedcoater:

- Extremely uniform printing image thanks to contour coating effect.
- Low web loading.
- Easy on-line installation.
- Much lower investment, operating and labour costs than off-line machines.
- Significant raw material savings.

Since it substantially reduces operating costs, payback time on Speedcoater investments is extremely short.

Developments and Trends in Coating Technology

Dr. Michael Trefz, Coating Technology R&D project manager, explained some of the current development goals and trends in coating technology. These include wider and faster machines, heavier coating densities, higher solids content, and of course on-line production concepts. Since all these developments must naturally have no detrimental effects on quality, the emphasis is on implementing intelligent concepts into new processes.

The highest coating densities and speeds are currently attained with blade coaters, and development work is now aimed at the “magic milestone” of 2500 m/min. Film coaters are very attractive from the point

Fig. 8: The front line of know-how: our speakers.

8

of view of cost-effectiveness and productivity, but still suffer from drawbacks with regard to film splitting and operating speed. The goal of developments in this connection is to overcome such problems, thus enabling higher coating densities at higher speeds.

Online technology trends are likewise taken into account by Voith Sulzer with numerous development projects, including a new Speedsizer generation.

The Future of Publishing and Demands on Paper Quality

Guest speaker *Armin Weichmann* of MAN Roland Printing Machinery Ltd gave an interesting overview of future developments in printing technology and resultant demands on the paper industry.

As far as rotogravure printing is concerned, trends are toward higher productivity with wider webs, easier block changing and faster setup, without any significant new demands on paper quality.

Offset printing paper still has to be optimized above all for better tear strength and registration precision. For waterless offset printing, particularly good pick resistance is required along with ink optimization. Demands in the electrophotography sector are increasingly on optimal surface quality, controlled porosity and conductivity, with specific surface requirements for indirect printing with liquid toners. The main improvements expected for inkjet printing paper are good absorption and better ink compatibility.

The future will therefore bring all kinds of challenges, which can only be met successfully through close teamwork between everyone concerned – printers, papermakers and machinery suppliers.

The new Brilliant Pilot Coater for speeds up to 2500 m/min

Against the background of the foregoing papers, *Ingo Gottwald* gave some details on further development of the Voith Sulzer pilot coater. The flexible arrangement and combination possibilities between individual aggregates make this truly a universal test facility.

After partaking of luncheon in good company with the VSPT pilot machine itself, our guests were able to witness theory unfolding into practice before their eyes. For the first time ever worldwide, they saw a pilot coater start up and proceed forthwith to coat both paper sides simultaneously at a speed of 2000 m/min.

The test was run with LWC raw paper at 36 g/m^2 basis weight, and a coating of 10 g/m^2 each side at 64.6% solid content. This gala premiere was fittingly concluded with a standing ovation…

Wire width 10,500 millimeters – two of the world's largest paper machines for China

With about 1.2 billion inhabitants today, China accounts for roughly a quarter of the world's entire population. It was this huge country whose advanced civilization gave us paper of the kind we use today. Today China is working with visible success on the expansion of its overall economy and infrastructure. And paper is part of this effort – whether as a means of information and communication within the county itself or as an export item to its neighboring states in Asia.

In the multi-national state of China with its 56 recognized ethnic groups, languages and dialects, more than 2000 national, regional and urban daily newspapers as well as some 8000 weekly or monthly magazines are published, quite a few of which have a circulation easily exceeding a million copies, since the Chinese are enthusiastic newspaper readers. Today the People's Republic of China is responsible for more than one third of Asia's entire paper consumption. Experts reckon that in Asia in general and in China in particular, the demand for paper and board will continue to rise in the coming years – regardless of temporary economic crises and cyclical fluctuations afflicting some of the countries. Thanks to its economically realistic and cautious expansion strategy, China itself has so far remained largely unaffected by such economic turbulences and continues to invest into its future – including among other things an efficient and powerful paper industry.

In the face of fierce competition, Voith Sulzer Papiertechnik won the contract to supply Asia Pulp & Paper Co. Ltd. with two papermaking machines for the production of writing and printing paper. The two plants will be erected in the

Dagang area in the province of Jiangsu. With a wire width of 10,500 mm and an operating speed of 1500 m/min, they are among the world's largest papermaking machines. Operation is scheduled to start early in 1999.

The decisive factor in securing this order was the innovative overall concept, with advanced system components provided by Voith Sulzer Papiertechnik to meet the high quality requirements and the preferred production and weight range, and last but not least to ensure the availability and reliability of the required machinery.

The concept includes ModuleJet headboxes designed specifically to improve the basis weight profile, CFD DuoFormers with flexible dewatering elements, NipcoFlex presses for the lowest possible moisture content and Speedsizers and soft calenders for correct surface treatment. In addition, the delivery program comprises the entire equipment from winding and slitting technology to auxiliary elements such as hood, steam and condensing systems and lubrication, drive and the electrical equipment.

In China the name Voith has a pleasant sound. Highly significant: the fact that the order awarded to Voith Sulzer Papiertechnik was accompanied by a second dramatic supply contract for China in which another Voith Group company – Voith Hydro – is largely involved. After decades of thorough preparation, planning and testing work, China is about to start building the project of the century: to tame flooding of the Yangtze River and to use it for environmentally compatible energy generation. The "China Yangtze Three Gorges Project" (see computer simulation at bottom left) is to become by far the largest hydroelectric generating plant in the world and will – with the last construction phase completed – have an output of 18,200 megawatts.

This capacity roughly equals the output of today's 22 most powerful coal-fired power stations, which, however, emit 100 million tons of CO_2 into the air. For this reason China has deliberately decided to utilize this ecologically more sensitive hydrodynamic power source to cover its industry's growing energy needs. Voith Hydro will supply the turbines for this gigantic hydroelectric power plant project, of which the first generating set is scheduled to start operation in 2003.

Mayr-Melnhof chooses Voith Sulzer technology for its first shoe press project

Europe's leading manufacturer of waste-paper-based folding boxboard, the Austrian Mayr-Melnhof AG company, which is quoted on the stock exchange, decided in late 1997 to have a significant rebuild carried out at its Frohnleiten mill.

The investment project concerns the wet end of BM3, which is already one of the Group's most efficient machines. The aim of this rebuild is to improve board quality and increase output.

With the decision to replace the second press by a NipcoFlex press, Mayr-Melnhof has taken an innovative step forward. This technology, which has been successfully used in graphic paper machines, is now gaining ground for board machines as well. The NipcoFlex press helps to increase output by reducing the moisture content after the press section, while retaining the bending stiffness of the board.

Sheet formation of the filler, which currently takes place on 7 suction formers, will be replaced by 2 fourdriniers (TopFormer F), one of which with a hybrid former (DuoFormer D). The Stepdiffusor headboxes that have already proven successful on the topliner and backliner wires of BM3 will be used also in the new sheet forming system. One of the new headboxes is equipped with dilution water CD profile control, the ModuleJet SD, and the other with a central distributor. Voith Sulzer Paper Technology's scope of supply also includes the rebuilt and new parts of the approach flow system. This major modification of the sheet forming system results in an improvement in formation. The use of the DuoFormer D in the filler line will permit the smoothness of the base board to be enhanced.

Stock Preparation Division:

Dispersion, stickies and optical cleanliness

The reduction of dirt specks and dispersion of stickies are two classical functions of dispersion. As regards dirt speck reduction, dispersion still makes a vital contribution. However, to alleviate the problem of stickies, screening has been improved in recent years. The reason is that just reducing the size of stickies results in them building up in the system, now that water and stock loops are increasingly being closed. Screening is an effective tool here. However, despite success in the screening out of stickies, dispersion will remain indispensable in future for white paper grades and high quality packaging papers.

The purpose of this article is to review the influence of machine design aspects and operating parameters on stickies dispersion and on the improvement of optical properties. Based on the many different functions of dispersion and the specific requirements of the end products, a general recommendation for the use of disk dispergers or kneading dispergers is made. Finally, different disperger systems are compared as regards their economic viability.

The two machine concepts

Basically, there are two types of dispersion machines: disk dispergers and kneading dispergers. The main differences between them relate to the shape and circumferential speed of their rotors and stators *(Figs. 1* and *2)*.

Voith Sulzer is the only machine supplier in the world who has been producing both machines for a very long time and

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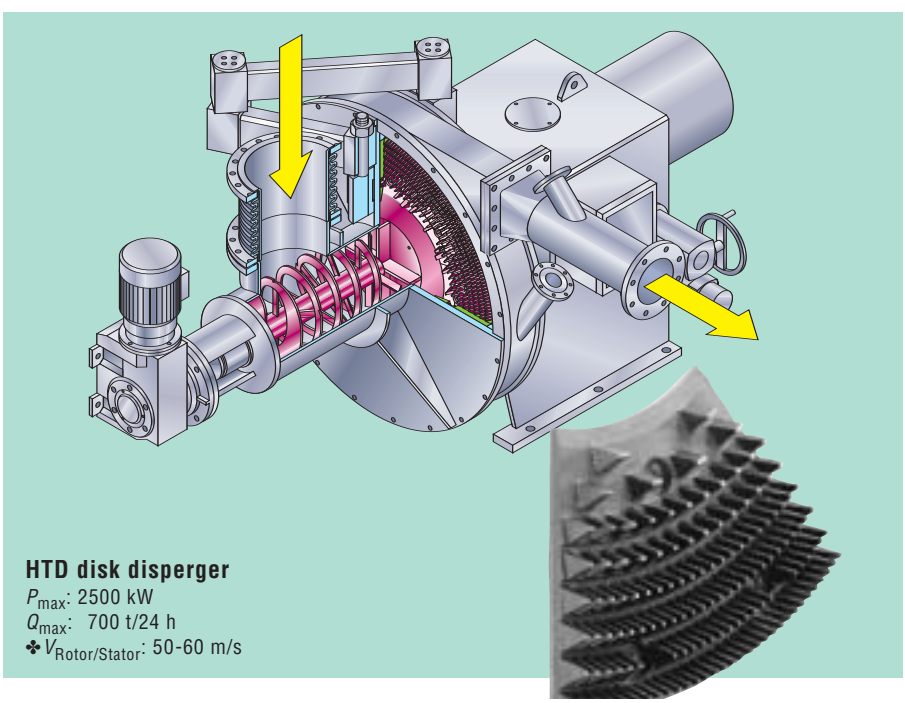

HTD disk disperger
P_{max}: 2500 kW
Q_{max}: 700 t/24 h
✤ $V_{Rotor/Stator}$: 50-60 m/s

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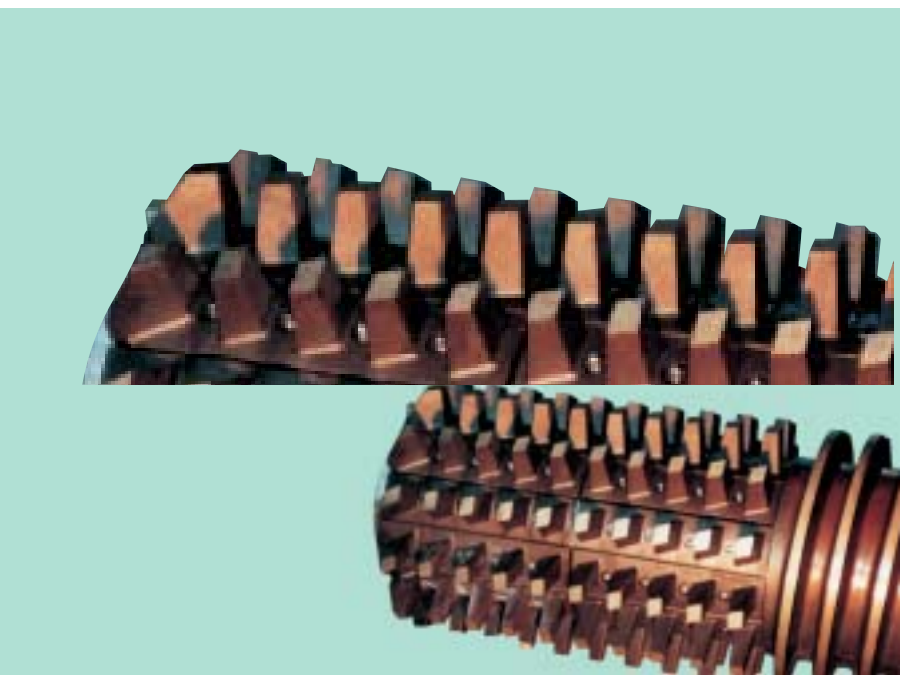

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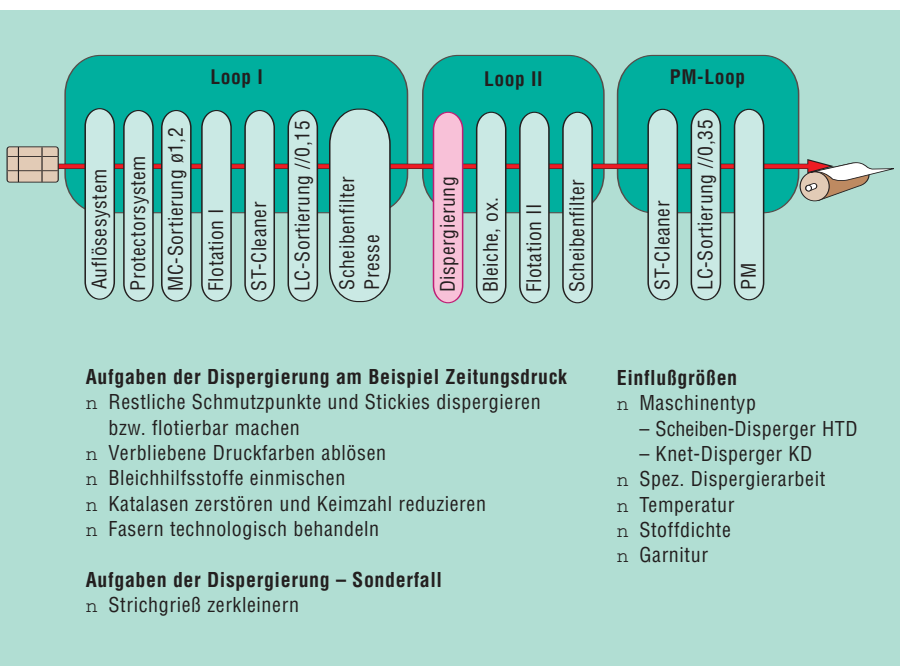


Aufgaben der Dispergierung am Beispiel Zeitungsdruck
- Restliche Schmutzpunkte und Stickies dispergieren bzw. flotierbar machen
- Verbliebene Druckfarben ablösen
- Bleichhilfsstoffe einmischen
- Katalasen zerstören und Keimzahl reduzieren
- Fasern technologisch behandeln

Aufgaben der Dispergierung – Sonderfall
- Strichgrieß zerkleinern

Einflußgrößen
- Maschinentyp
  – Scheiben-Disperger HTD
  – Knet-Disperger KD
- Spez. Dispergierarbeit
- Temperatur
- Stoffdichte
- Garnitur

Fig. 1: HTD disk disperger.

Fig. 2: KD kneading disperger.

Fig. 3: Tasks of dispersion – newsprint.

has therefore been able to accumulate unbiased experience of both concepts.

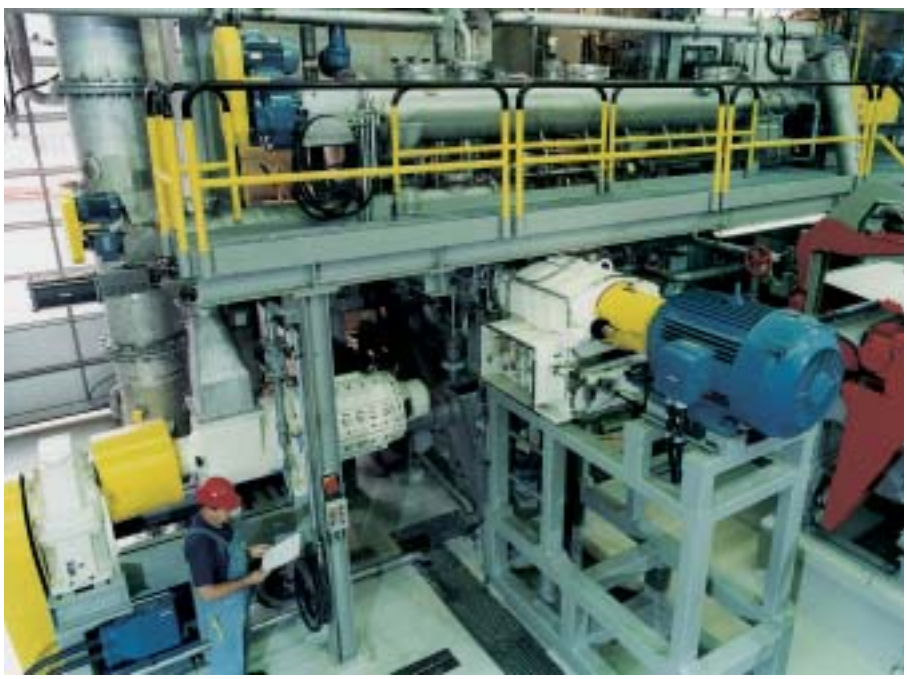
Both machines permit a throughput of 30 to 700 t/24 h each. In addition, the disk disperger is designed for operation under pressure at temperatures of up to 130°C. Apart from stickies and dirt speck reduction, the two machines handle other important tasks in the stock preparation process. These are shown in *Fig. 3,* using a system for newsprint production as an example.

Stickies dispersion

Closure of water and stock loops inevitably leads to a build up of stickies if these are not removed from the system. Using the latest screening technology, a level of stickies removal efficiency can be reached, at least in some brown systems, which is sufficient for problem-free operation of the board machine. In such cases, the dispersion of stickies is not required.

With high quality packaging paper, however, we continue to regard stickies dispersion as a useful feature, with graphic grades it is indispensable. Following fine screening, a certain size spectrum of stickies is still present and this represents a disturbing feature with graphic grades, one which is inadequately eliminated by flotation[1] or washing. Dispersion secures a better stickies removal efficiency in post flotation and improves the runnability of the paper machine and the quality of the end product. Apart from operating parameters, such as specific dispersion energy, temperature or stock consistency, the choice of the right

Fig. 4: High temperature disperger system.



dispersion machine in particular plays a decisive role in effectively combatting the problem of stickies.

Influence of the type of machine
Experience particularly from North America shows that a kneading disperger cannot disperse stickies as efficiently as a disk disperger. Certain mills in which kneading dispergers alone are used for wood-free office waste paper have had to contend with enormous stickies problems, regardless of the particular design of kneaders used[2].

Influence of operating parameters
As a general rule, higher stock consistency, temperature and specific dispersion energy have a beneficial effect on stickies dispersion. This is true of all waste paper grades. Specific dispersion energy has a particularly great influence on stickies dispersion.

For efficient stickies dispersion, it is sensible to warm the stock at least up to the temperature where the stickies soften. The operating temperatures of 70-95°C usual for disk dispergers are generally adequate for the stickies found in European waste paper grades.

On the other hand, for furnishes which are particularly hard to disperse such as AOCC, temperatures > 100°C may be appropriate. However, as high temperature treatment also results in strength losses[4], a test trial should definitely be conducted to enable a comparison of the advantages and drawbacks for a particular stock. The new high temperature disperger system in the Voith Sulzer pilot plant provides an ideal basis for this purpose *(Fig. 4)*.

Influence of the type of fillings
The type of fillings also has a certain influence on stickies dispersion. Voith Sulzer has been offering cast fillings for some years instead of the milled ones previously used in its disk dispergers. Cast fillings are typified by a particularly favourable cost-performance ratio, in addition to the usual long service life.

An evaluation of old and new test data shows that the cast fillings as opposed to the milled ones have a somewhat lower scatter range for the stickies area reduction[3]. A rather better average result was also achieved.

Optical cleanliness

Another principal task of dispersion is to ensure good optical characteristics. To improve optical cleanliness, several processes take place in the dispersion system.

- Dirt specks are detached from the fibres and so made flotatable.
- The flotatability of existing free or detached dirt specks is improved by changing the size spectrum.
- Dirt specks are reduced in size to below the visibility limit.
- Often, bleaching chemicals (H_2O_2) are mixed in.

The biggest influence on optical cleanliness is obtained by the specific disper-

Figs. 5, 6, 7: Dispersion of dirt specks: influence of specific dispersion energy.
❖ *Disk disperger 90°C*
■ *Kneading disperger 90°C*
★ *Kneading disperger 45°C.*

Fig. 5: 50% newspapers, 50% magazines with conventional printing inks after Flotation 1.

Figs. 6, 7: Office waste with laser print after Flotation 1.

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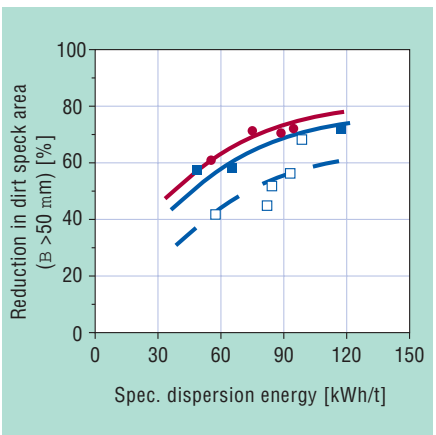

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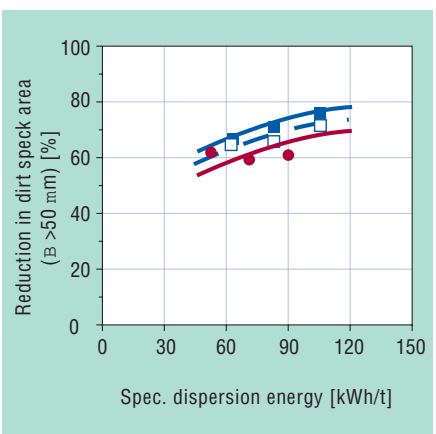

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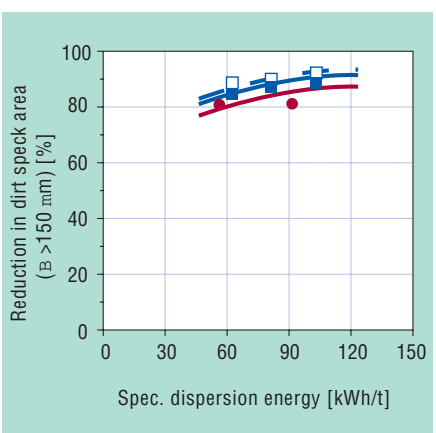

sion energy, machine type and, in the case of some stocks, temperature. Here the type of fillings and stock consistency tend only to have a limited influence.

Influence of machine type and specific dispersion energy

As shown in *Figs. 5* to *7*, the choice of machine type for optimum dirt speck reduction depends on the stock. With conventional, oil-based printing inks, the results obtained with the disk disperger are rather better than those reported with the kneading disperger *(Fig. 5)*.

On the other hand, for ink particles from non-impact printing processes, the kneading disperger gives a slight advantage over the disk disperger in reducing the overall dirt speck area *(Fig. 6* and *7)*.

In addition, the illustrations clearly show that dirt speck reduction increases with rising specific dispersion energy. This applies in principle to all white stocks but not to brown grades. For brown grades, homogenization of the stock is generally improved only to an insignificant degree when the specific dispersion energy is increased above 40 to 50 kWh/t.

Handsheets from brown stock before and after disk or kneading dispersion show that for the same specific dispersion energy both machines operate with approximately the same efficiency.

The two machine types are also equally suited as mixers for bleaching chemicals. There is no known influence of specific dispersion energy on mixing quality[4].

Temperature influence

The influence of temperature on the reduction of dirt specks is particularly apparent in the case of the kneader which can be operated in the 40 to 95°C inlet temperature range. *Fig. 5* shows that for conventional printing inks, hot operation brings distinct advantages over operation without heating. This operating mode also has certain advantages as regards dirt speck detachment for a post-flotation stage.

For non-impact printing inks too, the hot kneading disperger process is again somewhat more effective as regards the reduction of all visible dirt specks, i.e. all particles with a diameter larger than 50 ❍m *(Fig. 6)*. On the other hand, with the reduction of dirt speck areas for particles >150 ❍m *(Fig. 7)* corresponding to the old Tappi Standard, the best results tend to be obtained with the cold kneading disperger. This explains why many kneaders are run at process temperature for this type of stock in North America where the reduction of the dirt speck area is generally assessed according to the Tappi Standard.

Technically, it is also possible to run both the disk disperger and the kneading disperger without heating. However, unlike the kneading disperger, in the case of the disk disperger, the increase in SR freeness is higher at the lower temperatures. Therefore, the disk disperger should only be run cold in special cases such as HC refining. On the other hand, the SR value does not change in the case of the kneading disperger, regardless of the temperature at which this machine is run *(Fig. 8)*.

Fig. 8: Influence of dispersion temperature on the SR value. Office waste, $W_{spec.}$ = 80 kWh/t.
❖ *Disk disperger*
■ *Kneading disperger*

Fig. 9: Dispersion of dirt specks. Influence of temperature. 20% office waste, 40% newspapers, 40% magazines. Disk disperger, $W_{spec.}$ = 60 kWh/t.
■ *Reduction in dirt speck area*
❖ *Breaking length*
--- *Breaking length before dispersion*

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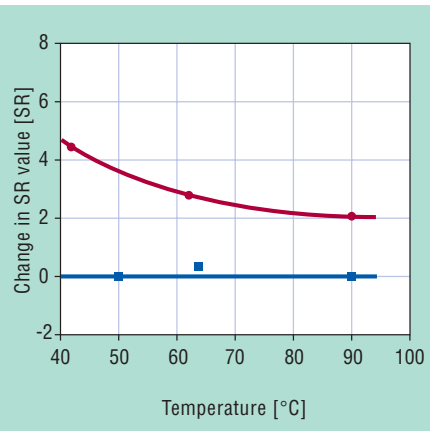

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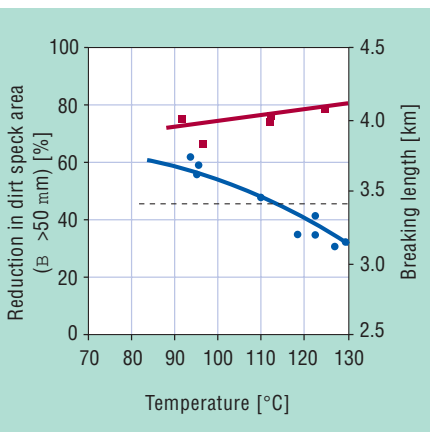

Temperatures >100°C are generally chosen to ensure high bacteriological cleanliness[5,6]. As temperature rises, the dirt speck area reduction is somewhat greater *(Fig. 9)*. *Fig. 9* shows however, that the breaking length drops significantly as the temperature rises. A test trial can demonstrate how the strength values of a particular stock change as temperature rises.

Recommended use and economy

Fig. 10 describes the resulting recommendations for use of the two types of disperger. In principle, we recommend at least one disk disperger when stickies problems are expected. The kneading disperger is suitable for mills with two dispersion stages, for operation at lower temperatures and for stocks which react sensitively to an increase in SR freeness. Apart from the technological criteria for decision-making, economic considerations also play a significant role in the choice of the type of disperger. The economic study shown in *Fig. 11* is intended to help in reaching decisions. It illustrates the operating costs in DM/t dispersed stock for four typical Voith Sulzer disperger plants. A depreciation period of 5 years is allowed.

- Plant 1: Pressure dispersion system with screw press and disk disperger.
- Plant 2: Pressure dispersion system with double wire press, plug screw and disk disperger.
- Plant 3: Same as plant 2, but for max. 90°C only, i.e. without plug screw and without pressure heating screw.
- Plant 4: Kneading dispersion system with screw press but no heating screw; increase in temperature of max. 30°C through steam heating possible in the kneading disperger.

As the summary shows, the bulk of the operating costs are accounted for by steam and electricity. Depreciation represents only a relatively small part of the overall cost. This is particularly true for a system run at 130°C.

As far as possible, a dispersion plant should therefore not be run at a temperature in excess of 90°C. However, the additional investment in a pressure disperger system is soon recouped if a problematic stock requires temperatures in excess of 100°C even for short periods.

The capital costs of a plant with a screw press (plant 1) and one with a double wire press (including tear, ascending and plug screw) (plant 2) are comparable. The decision as to the use of the most suitable dewatering unit should therefore depend on technology considerations, the space required and the preferred operating mode.

A cold kneading disperger plant is by far the most economical system albeit with slightly reduced dispersion of disturbing substances. If quality differences in the stock require high temperatures for instance, the stock can be heated up by at least 30°C in the kneading disperger without the addition of a heating screw by direct admission of steam to the kneading chamber.

Fig. 10: Application recommendations for disperger machines.

Fig. 11: Typical dispersion systems – operating costs.
- *Depreciation*
- *Fillings*
- *Electricity 0.11 DM/kWh*
- *Steam (stock temperature 90°C/130°C) 28 DM/t steam.*

10

Applications	Furnish		Recommended machines	Remarks
Newsprint Board topliner	white	wood-cont., wood-free	Disk disperger	stickies
Tissue	white	wood-cont., wood-free	Disk disperger Kneading disperger	stickies bulk
SC, LWC	white	wood-cont.,	Disk disperger + Disk disperger	strength properties stickies
Market DIP	white	wood-free	Disk disperger + Kneading disperger	stickies + gentle fibre treatment
Topliner	brown	–	Disk disperger	optical and strength properties, stickies
Board filler	brown	–	Kneading disperger	max. bulk
Coated broke	white	–	Kneading disperger	gentle fibre treatment at low temperatures

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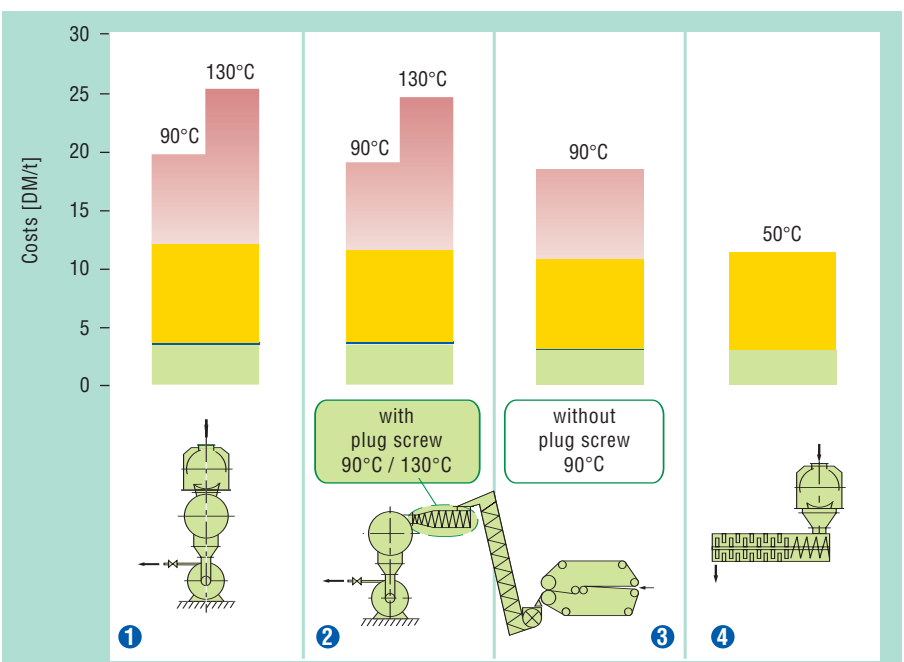

Conclusions

Dispersion remains an important process stage for the cleanliness of stocks from waste paper. However, operating parameters such as temperature, stock consistency and the choice of machine type have a varying degree of influence on optical cleanliness and stickies dispersion. This aspect must be taken into account when systems are designed and operated. Voith Sulzer has many years of experience, both with disk dispergers and with kneading dispergers.

The decision for a particular installation should be based not only on such technological experience but also on the economic considerations of the different types of plants.

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Stock Preparation Division:
New possibilities for water management

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Paper manufacturing is recognized today as an environmentally friendly industry, achieving the highest recycling rates. However, if one looks at the paper production process somewhat closer, it becomes apparent that valuable water resources are still being used all too liberally. In addition, clean fresh water is often not available in the quantities required and so for some mills reducing water consumption has developed into a question of survival.

Fundamental Dependencies

The basic relationship when closing up loops is illustrated in *Fig. 1*. The concentration of all dissolved substances drastically increases when specific effluent or fresh water volumes are reduced[1]. Despite heavily increased concentrations in loop water as well as in effluent, the concentration of substances discharged with the effluent decreases disproportionally, the more the loops are closed up. If no water cleaning is provided for fulfilling a so-called “kidney function”, then in the extreme case of completely closed water loops, all undesirable substances pass into the paper, apart from a small amount leaving the system in the residual discharge.

Disturbing substances

In paper production, disturbing substances are predominantly fibre related materials and in no case problem materials with toxic relevance. For instance, during swelling of the fibres natural hydrocarbons dissolve[2]. Along with various paper additives they build up in the loop water and in some cases can develop a relatively unpleasant life of their own. For example, starch in loop water easily hydrolyzes into glucose. Acid-forming bacteria leave behind volatile fatty acids as a product of metabolism and these can be the cause of bad odours. The pallet of possible negative influences runs from stickies formation right through to disturbing the formation of hydrogen bonds.

In the end, product quality is affected as regards strength and optical characteristics. *Fig. 2* provides an overview of the size spectrum of these substances. In addition to the organic substances already mentioned, further ones may also be found (lignin fragments, wood extract substances, saccharides and hemi-celluloses). Inorganic substances are also present. The latter are mainly introduced with the fibre stock (e.g. manganese) or they enter the system with the fresh water (e.g. chlorine). Contrary to opinions still being heard today, additives make no significant contribution to the load of disturbing substances (for example, sulfate from reductive bleaching).

Separation processes

All previously discussed substances have the unpleasant characteristic in common

Fig. 1: Accumulation of disturbing substances.

Fig. 2: Substances in the process water.

Fig. 3: Separation processes for removal of disturbing substances.

Fig. 4: Flux through membranes for paper mill effluent.

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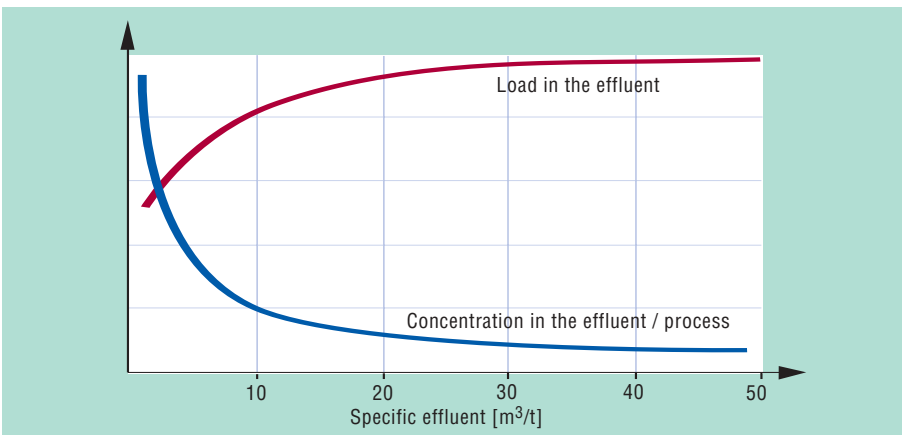

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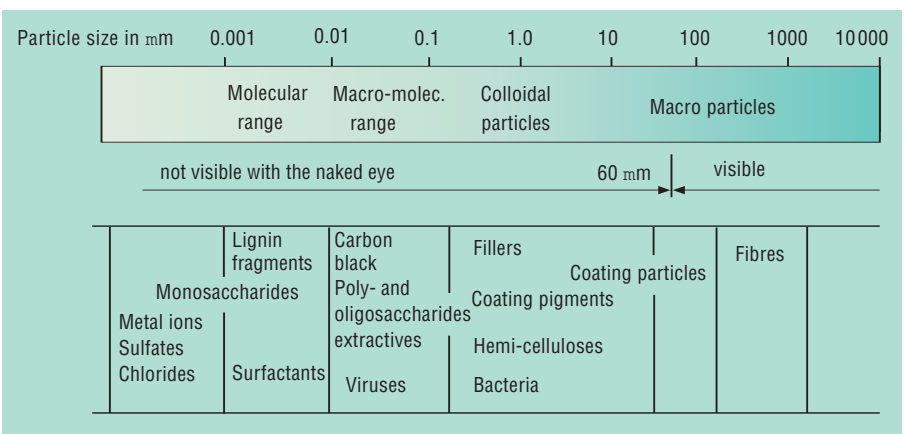

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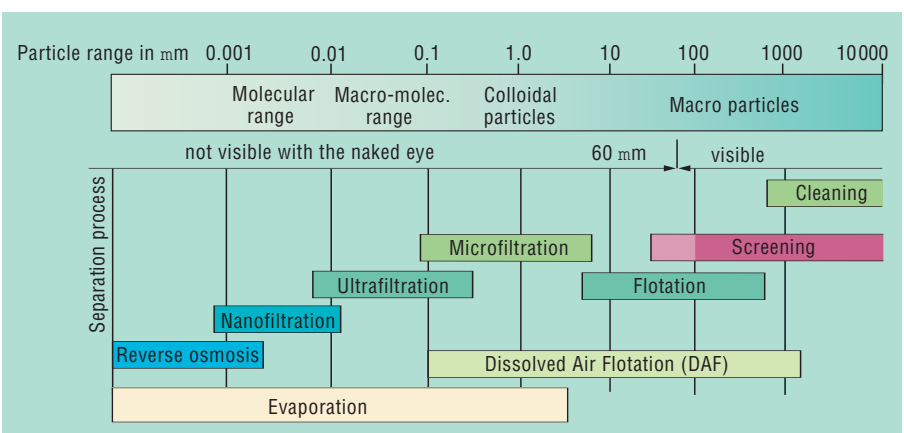

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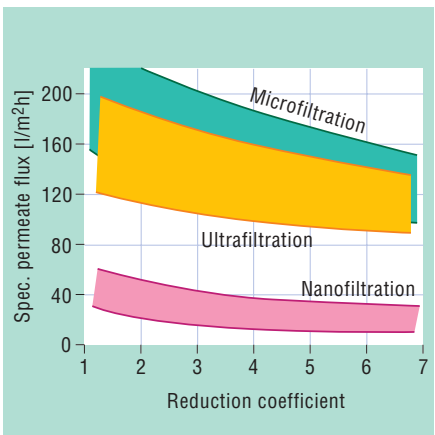
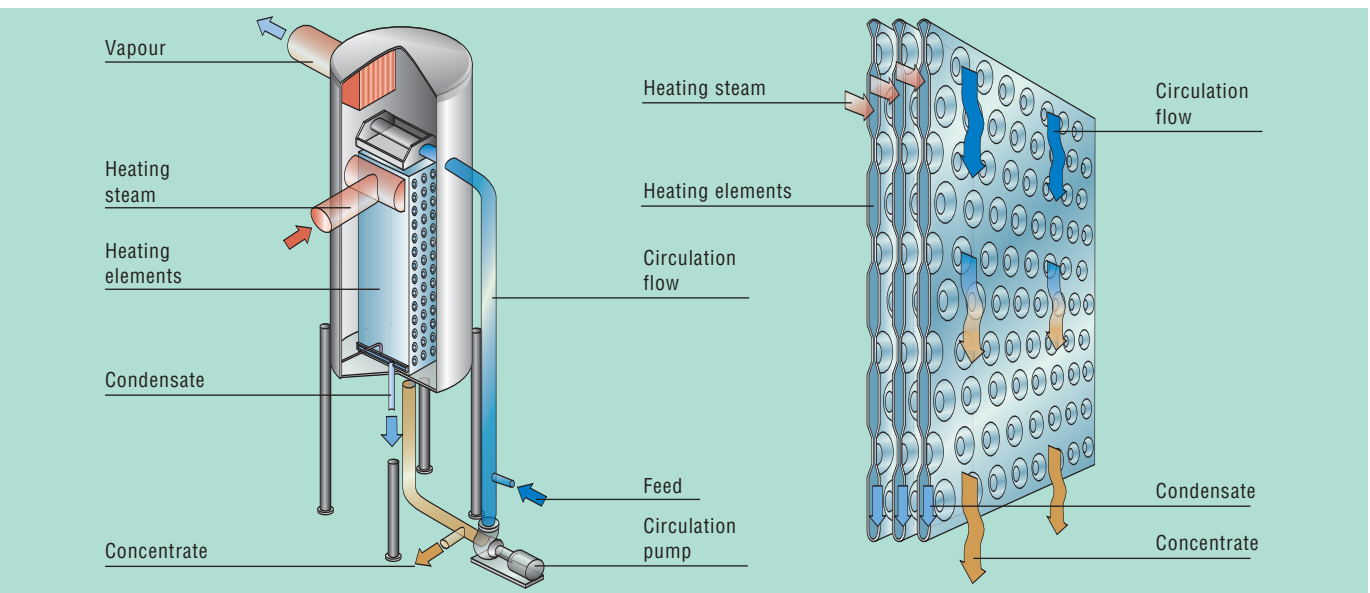


that they cannot be removed in conventional cleaning and screening processes. Once they are dissolved they can only be removed from the fibre flow through water exchange[3]. The filtrates from washing and thickening machines still have to be subjected to further cleaning.

Possible filtrate treatment processes are outlined in *Fig. 3* for the mentioned particle size spectrum. Microflotation ensures that flocks formed following chemical pre-treatment can adhere to air bubbles and thus flotate together with these. All membrane separation processes from microfiltration via ultra- and nanofiltration, right through to reverse osmosis operate using filter units that retain all particles and dissolved substances larger than the respective “pore sizes”. However, the selectivity of these processes is often not sufficient. Evaporation finally separates practically all substances relevant in paper production. The problem of

Fig. 5: Falling film evaporator.



volatile substances will be discussed in further detail later.

Membrane filtration

Membrane filtration processes are used in many areas of effluent treatment. Treatment of leakage water from rubbish dumps, cleaning of toxic industrial effluent or sea water desalinization can be cited here as examples. There are two reasons why membrane filtration has not established itself in the paper industry. For one, effluent from the paper industry is not loaded with toxic or other harmful substances and the second reason is that the already mentioned substances of organic origin can be easily, quickly and, above all, inexpensively decomposed biologically. Biology however, cannot remove the inorganic load of salts from the treated water flow.

Design, separation efficiencies, and application limits of membrane filtration have already been presented in twogether No. 3. To summarize, the probably most significant disadvantage of all membrane filtration processes, namely that the specific permeate flux is very low *(Fig. 4),* should be mentioned again here. The result is very high investment and operating costs and this principle does not allow more than a very small influence on flow rates[4, 5]. In the past few years, however, membrane filtration has received new impulses in a different direction. With water containing a low solids load, cross flow operation can be eliminated. With "dead-end" operation, ultrafiltrations, for example, can be operated considerably more easily and inexpensively today. In addition, mechanical clearing devices, comparable with the rotor foils of a pressure screen, today allow higher retentate concentrations in the case of water containing a high level of solids[6, 7].

Evaporation

In evaporation all non-volatile substances can be virtually completely separated out. The condensate has fresh water quality and can therefore be re-introduced into the process. Multi-stage evaporation units have established themselves early on in the pulp industry. Because of its favourable efficiency factor and low energy requirement, the falling film evaporator *(Fig. 5)* is highly suitable for application in the paper industry. Evaporation and subsequent combustion of concentrated substances in pulp pro-

Fig. 6: Packaging papers: limited effluent. COD load in kg/min. Effluent: 4.0 m³/t, COD process water: 7500 ppm.

Fig. 7: Packaging papers: closed loop with integrated biology. COD load in kg/min. Process water to biology: 4.0 m³/t, effluent: 0 m³/t, COD process water: 7700 ppm.

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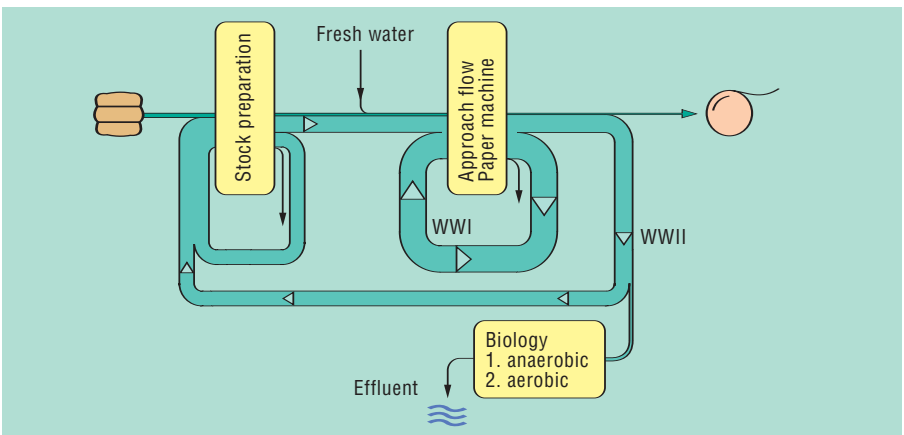

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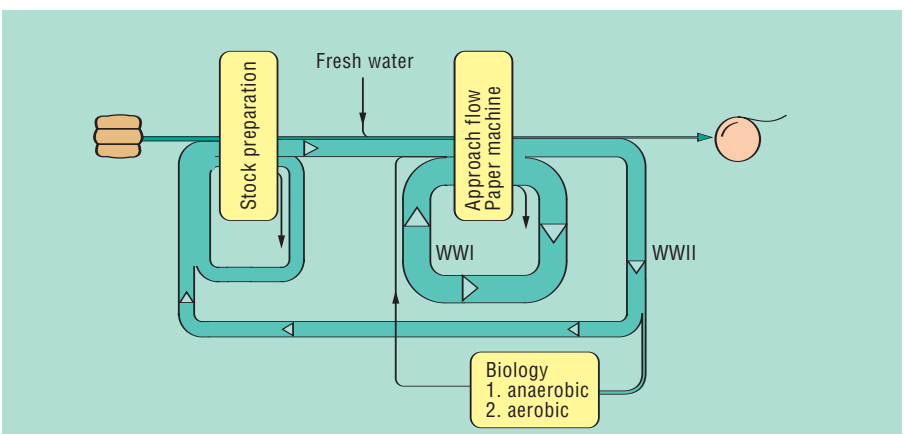

duction provide a high energy potential and in paper production, the reduced effluent volumes help offset the high costs involved. The processes are perfected and operationally safe. The first applications with complete water loop closing (zero effluent) have already been reported[8, 9].

It should be added in this context that during the evaporation of heavily loaded process water, highly volatile organic compounds such as acetic acid, etc., must be separated. For instance, the initially evaporated volume, mainly containing volatile substances, can be discharged as effluent (foul condensate). However, if effluent that has been biologically cleaned is evaporated, then all the recovered condensate can be re-used. All highly volatile acids are degradable due to the long dwell time and aeration in the biology stage.

Water management and closing up loops

Using two examples, the following discusses what level of loop closure can be achieved with today's state of the art technology.

Packaging papers

Particularly in the production of liner and fluting from recycled paper, long term experience with totally closed loops without water cleaning is available. The problems associated with this are also well known. By choosing appropriate non-corrosive materials, excessive addition of chemical aids, careful process flow operation and frequent cleaning intervals, such systems can certainly demonstrate good runnability. However, papers manufactured in this way are burdened by odour and RCT/SCT strength problems can also occur[10, 11].

With the high recycling quotas for packaging grades and the considerable amounts of starch added into the produced paper, the continuous build-up of dissolved substances is bound to lead to system collapse. For this reason, all plants are currently designed either with an efficient system effluent discharge or with internal biological water cleaning. The calculated loads circulating in the system are illustrated in *Figs. 6* and *7*. If the system is operated with a specific effluent value of 4m³/t, corresponding to approx. 5.7m³/t fresh water, a COD concentration of approx. 7,500 ppm is present in the effluent.

Fig. 8: Graphic papers: water management for limited effluent. Spec. volume flow [m^3/t].

Fig. 9: Graphic papers: water management for a greater degree of water loop water closure. Spec. volume flow [m^3/t].

Fig. 10: Graphic papers: water management for zero effluent. Spec. volume flow [m^3/t].

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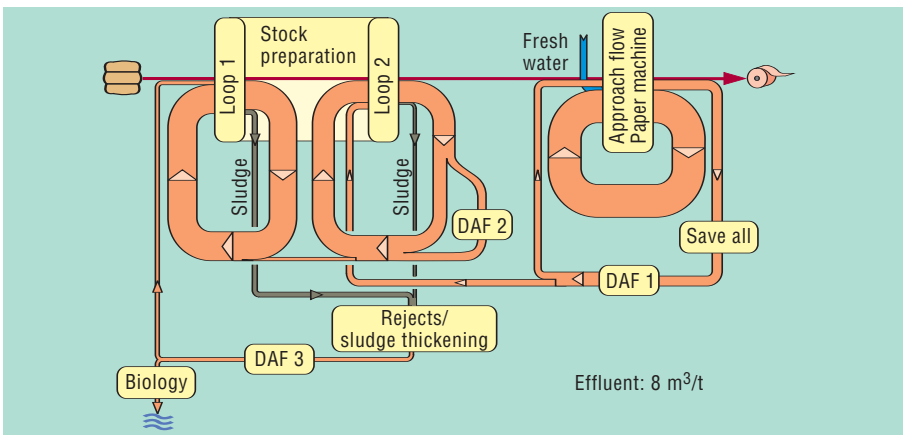

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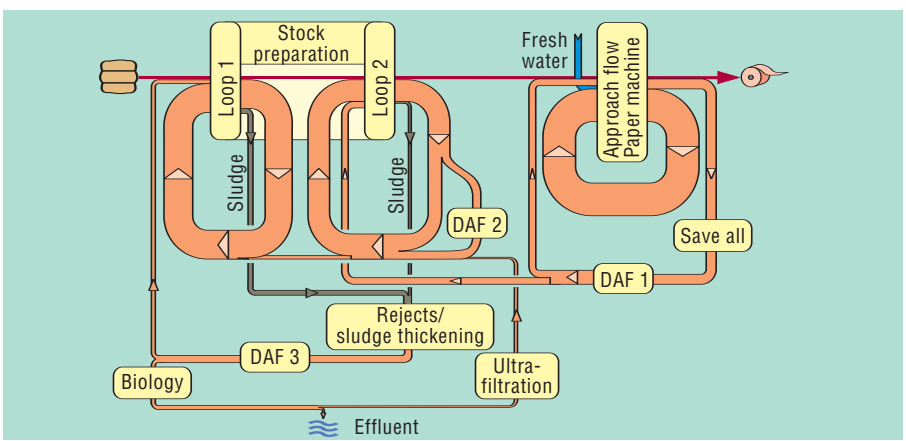

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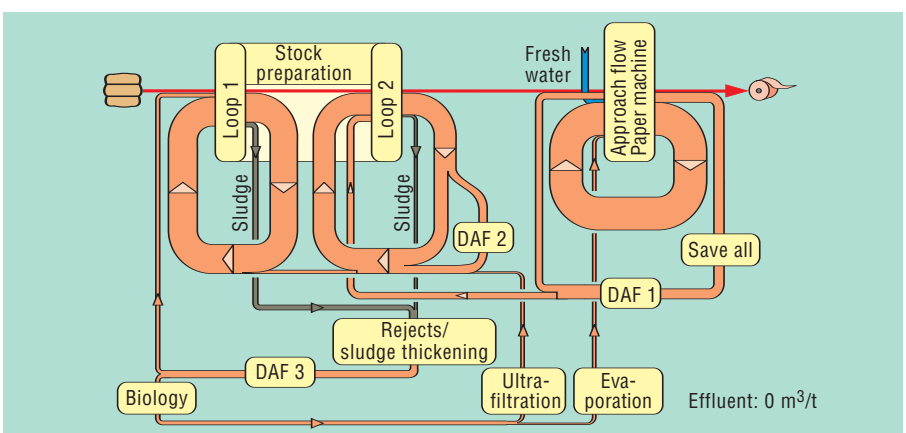
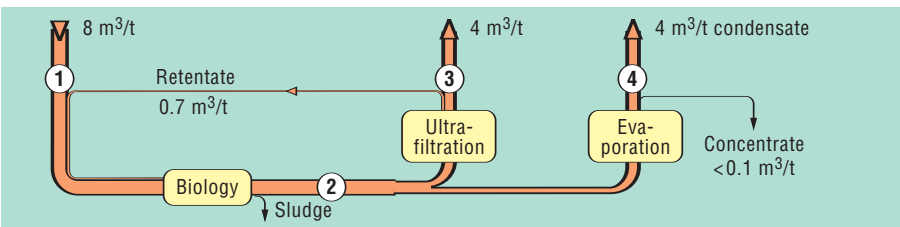


The Sankey diagram in Fig. 6 illustrates the circulating COD loads for this example. Because of the low concentration gradient from the preparation loop to the PM loop the circulating water volumes are the same[12]. The biology in this instance is “end of pipe”. It fulfills the sole task of cleaning the effluent prior to its discharge from the mill. If the water loop is completely closed, the COD concentration increases to 30,000 ppm or more. Odour problems as well as reduced strength properties are unavoidable under these conditions.

However, if biological process water clarification for a specific effluent volume of 4 m^3/t is integrated into a completely closed water loop, a COD concentration of approx. 7,700 ppm is reached in the loop water *(Fig. 7)*. Experience shows that COD concentrations below 10,000 ppm are not problematic, the effectiveness of additives is good and runnability problems due to deposits or product quality impairment as already mentioned, need not be feared as long as there is adequate cleaning and screening of the stock flow. The biologically clarified water is additionally cleaned through a sand filter and can also be conditioned by the addition of flocculants. It is then available for re-use as a substitute for fresh water at the paper machine. Experience has also shown that the processes can be controlled well if there is efficient planning of the overall water management process[13, 14].

Fig. 11: Results of advanced water treatment (lab tests).



No.	Sample	TSS [ppm]	pH	COD	Conductivity [mS/m]	Turbidity [NTU]
1	Feed biology	100	8.1	3600	2520	310
2	After biology	10	7.7	320	2460	25
3	After ultrafiltration	B	7.7	130	2310	7
4	After evaporation	B	7.5	<100	<10	<0.01

11

The additional costs for subsequent cleaning in the biology stage can be offset to some extent by simplified approval procedures by the authorities, lower costs for fresh water preparation as well as the elimination of effluent discharge levies. For some mills the decision to install a completely closed system can therefore already be economically justified today.

Graphic grades

The possibilities of further closing up water loops or completely closing them are now discussed using the production of newsprint from deinked stock (newspapers, magazines) as an example[15, 16].

The best basis for evaluating water management is provided by a Sankey diagram of the water volumes in circulation. *Fig. 8* illustrates this for the cited newsprint example. The process components are blockwise combined into water loops. Water routing consistently follows the counter current principle. Fresh water is added only at the paper machine. Following filtration, white water II surplus is cleaned in the fibre recovery stage and used as dilution water after the storage tower or in Loop 2 in stock preparation. Loop 2 supplements Loop 1. The filtrates from sludge dewatering and rejects thickening can be cleaned via a separate microflotation, if a partial flow is routed back into Loop 1. The other section represents the actual system discharge. The effluent is cleaned biologically before being discharged from the mill. This design represents state of the art technology. Specific effluent volumes of approx. 8 m³/t are achievable without compromising the process technology or product quality. With a further closing up of the loops, the dissolved loop load increases disproportionately as already shown by the curve in *Fig. 1.* Associated with this are the well-known problems of reduced efficiency of the bleaching, deinking and retention aids, poorer optical characteristics of the finished paper, as well as increased deposits on the paper machine. If one views the biology stage as providing highly efficient clarification for disturbing dissolved or colloidal substances, then reuse of the biologically cleaned water is a virtual must[17].

If, however, the flow from the biology stage is directly fed back – even after efficient mechanical/chemical post cleaning – then microorganisms or their metabolisms will unquestionably be carried into the process water. *Fig. 9* schematically illustrates that a partial flow from the biology stage is cleaned through ultrafiltration, before it is routed into Loop 2.

Detailed balancing of process relevant substances in the water shows that loop closure up to approx. 4 m³/t can be achieved. This remaining effluent volume is basically essential to flush out the salt load brought in with the recycled paper and additives. The transition from these contemplations to the scenario illustrated in *Fig. 10* is smooth. If a fully closed loop is required, a specific water volume of approx. 4 m³/t must be evaporated. With optimum process design (no aluminium sulfate, no dithionite) a reduction down to 2 m³/t is feasible. Due to complex chemical interactions in the heterogeneous stock, influences upon the finished paper characteristics cannot, however, be exactly defined today.

Fig. 12: Rough estimation of water treatment costs.

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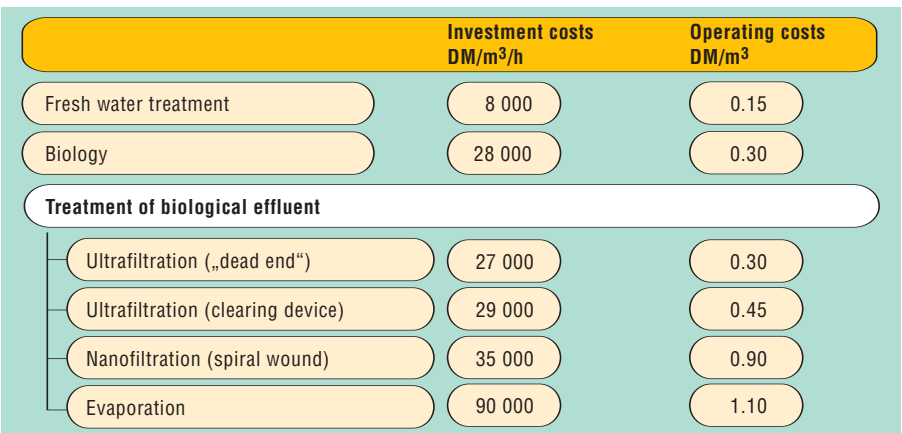

	Investment costs DM/m³/h	Operating costs DM/m³
Fresh water treatment	8 000	0.15
Biology	28 000	0.30
Treatment of biological effluent		
Ultrafiltration („dead end“)	27 000	0.30
Ultrafiltration (clearing device)	29 000	0.45
Nanofiltration (spiral wound)	35 000	0.90
Evaporation	90 000	1.10

Just how the most important parameters change over these treatment stages is summarized in *Fig. 11*. The results shown here represent a cross section of many individual measurements.

Despite these undoubtedly impressive values, it must be stressed that additional investment and operating costs will occur for further water cleaning via membrane filtration and evaporation, and these are offset only to a small degree by the lower costs for fresh water preparation and elimination of effluent discharge levies. *Fig. 12* gives broad trend values for the described treatment processes.

In summarizing, it can be said that complete loop closure for high quality graphic grades appears possible today, but it is associated with considerable additional costs for the installation and operation of the additionally required systems technology.

Outlook

Even though effluent from the paper industry as a rule is non-toxic and not loaded with harmful contaminants, the further closure of loops to preserve fresh water resources appears unavoidable in the future. With packaging grades, economic advantages today make the decision to install a completely closed plant easier. New impulses have reduced the costs of membrane filtration and at the same time the process has become operationally more reliable. But despite this, a zero-effluent system for graphic grades is still subject to considerably higher costs. Due to the pressure for better water utilization, membrane filtration as well as evaporation will continue to steadily establish themselves. However, the objective cannot be to demand a completely closed system at any cost, but rather to aim for an economically justifiable reduction in water requirement, tailored to each specific location.

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Machine concept

In February 1996 SCA Graphic Paper, Sundsvall, Sweden started up their PM 4 after an installation time of only five months. This machine produces LWC offset printing paper according to a new concept which is so far unique. For the first time, all production stages are incorporated on a continuous online basis. Instead of the two or three supercalenders needed by other producers for ensuring the gloss and smoothness required of LWC grades, the Ortviken machine delivers a finished product.

This concept, unprecedented for speed and quality, offers substantial advantages over conventional LWC lines both with regard to investment outlay and operating costs. *Fig. 2* shows the differences between conventional product lines and the Ortviken PM 4. Classical LWC production lines comprise firstly a paper machine, the output reels of which are rewound before coating and calendering. All time lost due to rewinding has to be made up by a 15 to 20% speed increase in coating. The supercalenders used for final finishing cannot keep up with such coating speeds, however, so that production capacity can only be met by increasing their number. Furthermore, any web breakage or other trouble in the coating and calendering zones holds up reeling, and may even lead to paper machine shutdown. With an online machine such as PM4 in Ortviken, all these problems are eliminated since paper production, coating and calendering are integrated into a continuous process. This great advantage has its price, however:

Since the overall efficiency is made up of the individual machinery efficiencies – with no buffers or correction possibilities between them any longer – every single

Fig. 1: The wet section DuoFormer CFD.

Fig. 2: Conventional LWC production line compared to an advanced concept.

Fig. 3: Development of a new coating technique.

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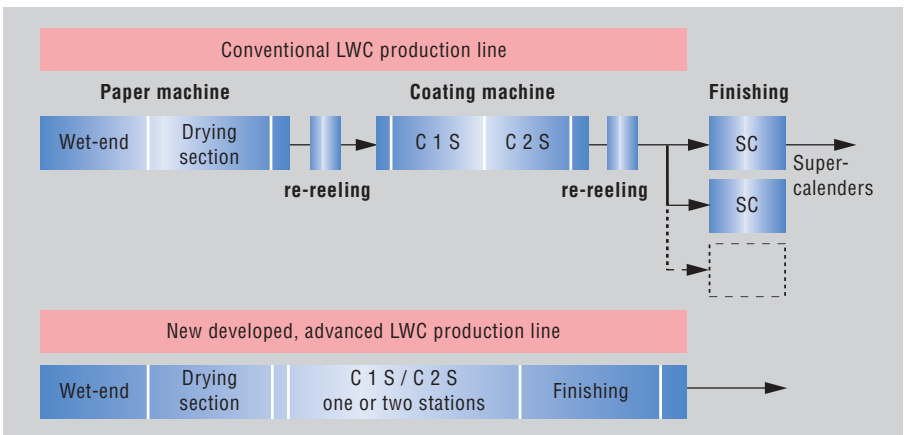

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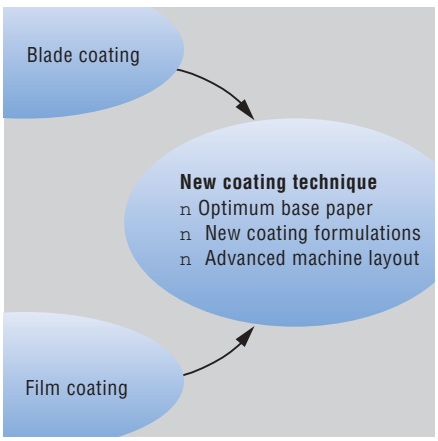


line element must be 100% available.This demanding requirement not only applies to the machinery itself, but also to raw material supplies and the operating team.

Likewise for the Voith Sulzer commissioning engineers and the Heidenheim and Krefeld specialists, starting up and optimizing PM 4 was a great challenge. Nevertheless, most of the extremely demanding guarantee data were fulfilled.

Process development

In order to implement this promising online concept successfully, each individual component must be highly efficient and reliable. This was not possible with the aggregates formerly available, particularly with regard to coating technology which plays a key role. The need for minimal web stress and long doctor blade cycle time had to be coordinated with high demands on coating quality and a reliable control strategy.

This problem was solved by developing the Speedcoater. Spurred on by the Ortviken PM 4 project, the design draft was matured in the record time of only six months to the first prototype trials on our test facility. And that was when the development teams of SCA Graphic Paper and Voith Sulzer Paper Technology began their ongoing success story.

Fig. 3 shows the main steps in developing this new production technique for PM 4 in Ortviken. Thanks to two years of intensive collaboration, we were fully able to reach our quality goals with the new process.

The Speedcoaters on PM 4 are the first VSPT coaters where sizing is predosed with smooth doctor blades. Compared with conventional coating technology using grooved blades, this extends cycle times to a matter of weeks. Furthermore, coating thickness is easily kept constant by automatic control of application pressure.

In order to maintain the machine efficiency as high as possible, we decided to use only one calender nip on each side. This was achieved by installing two compact calenders, which operate under conditions exceeding all limits known so far. Even with this superlative technology, the raw paper characteristics and coating recipes had to be optimized to achieve a product quality comparable with that of commercial LWC offset printing papers.

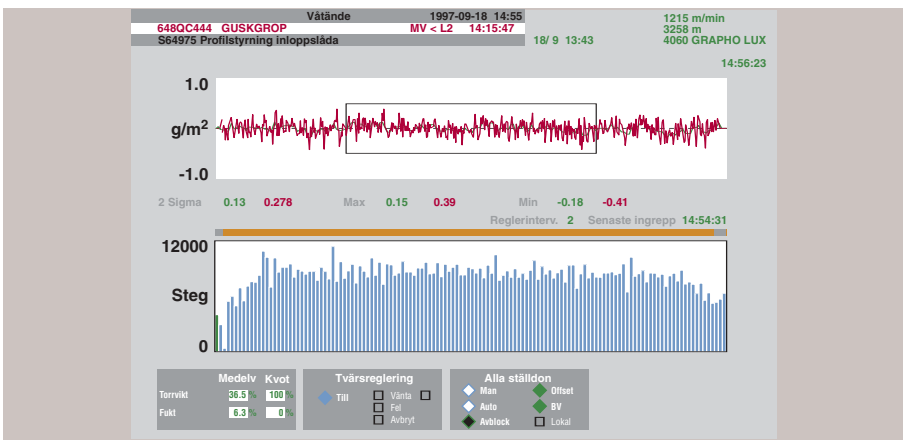
During printing tests, the true benefits of this new concept were revealed. The absolutely uniform coating contour attained with the Speedcoater resulted in better coverage than with blade-coated papers. Combined with the high surface temperatures in the soft-compact calenders, this led to extremely good printability.

Since only one calender nip is needed on each side of the paper, not only are its optical characteristics better, but it has a higher volume than conventional LWC grades.

Commissioning and operating experience

Commissioning of PM 4 started at the end of January 1996. The month of February brought plenty of teething troubles and

Fig. 4: Basis weight cross-profile.



outage time due to the unfamiliarity of newsprint producers with this new process. Improvements had to be made mainly in the web transfer system and gas supplies to the dryer and coating system. The first significant LWC production started when the machine was handed over to the customer on March 8, 1996. In the meantime all components were functioning reliably, and the operating team had been trained to the point where regular operation was possible. Now began the optimization phase, mainly aimed at fulfilling the paper quality guarantees.

To this purpose the Voith Sulzer Paper Technology development engineers were in attendance, and together with SCA Graphic Paper, two years of well-oiled teamwork won the battle – all gloss and smoothness guarantees were fulfilled.

The key to this success was the comprehensive and systematic procedure, which is indispensable with such a complex online machine. Our work was also assisted by the optimal measuring and control systems provided.

Thanks to this, the effects on product quality of parameter changes in the approach flow or wet sections could be established practically instantaneously.

The first production guarantee of 1000 tonnes per 48 hours was fulfilled on May 3, 1996, and the following month brought a further increase in efficiency.

During commissioning and the first few months of operation, operating speed was around 1000 to 1090 m/min. In the meantime this has been increased significantly, and at the time of writing the machine is operating at 1240 m/min.

The maximum weekly output of highest quality LWC paper is 4740 tonnes, corresponding to an efficiency of 85%. This reflects the choice of coating process: while three to five web ruptures per day are normal with online blade coaters for both coating stations, the two Speedcoaters operated during the first year with only 1.5 ruptures per day. Coating thickness, which is so important for final product quality, is automatically regulated by controlling the application pressure of the smooth doctor blades. This enables compensation of all fluctuations in coating consistency. Furthermore, the roll and blade cycle times reach several weeks even at these high speeds.

High quality coating cross-profiles are ensured by selecting optimal roll covers, and the cross-profile of the raw paper is excellent thanks to the ModuleJet headbox. As shown in *Fig. 4*, the basis weight cross-profile has a 2-sigma value of only 0.15%.

Good 2-sidedness of the LWC paper product was an important design criterion. By means of the soft-compact calender, 2-sided roughness in the 3-nip press is corrected naturally by first calendering the rougher side.

The secret of the high gloss achieved with only one calender nip on each side of the paper lies in the coating recipe and the extremely high surface temperature of the thermorolls. This also means, however, that the soft-compact calender has to operate at the limits of present-day feasibility both with regard to temperature and line force.

After more than eighteen months of operation, the market trend in LWC paper has also changed, in this case toward lighter grades. Apart from the main product grade at 60 g/m^2 basis weight, LWC papers with a final basis weight below 50 g/m^2 are also produced now. Thanks to its tailored concept and innovative Speedcoaters, this is no problem for the Ortviken PM 4.

1

Paper Machinery Divisions:

DuoFormer Top – a new former for top plies of packaging papers

The author:
Dr. Günter Halmschlager, Product Development Manager, Paper Machine Division Board and Packaging

The newly-developed DuoFormer Top is a top-layer gap former that transfers the advantages of the gap forming technology relevant to packaging papers – so far only available for base plies – to the production of separately-formed top plies. This paper describes the design of the unit and the various technological relations playing a part in achieving the required product quality.

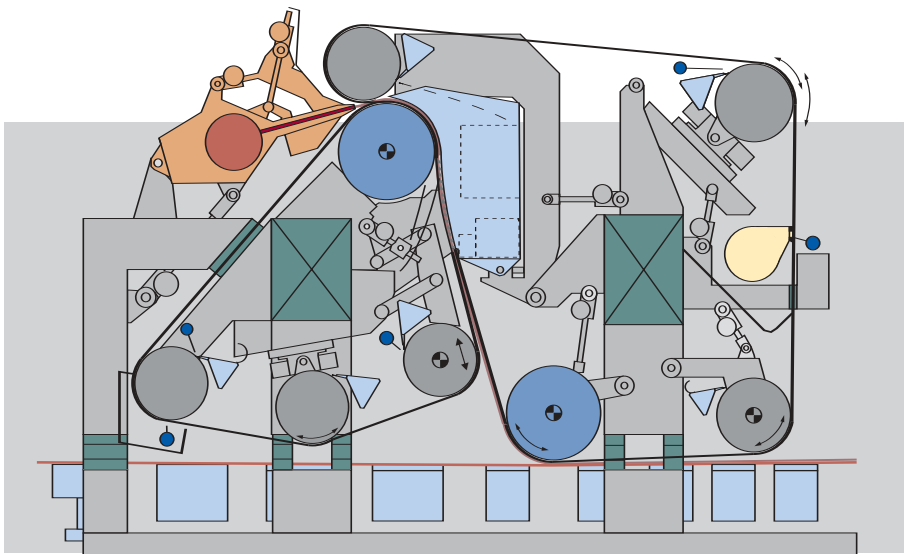
With this unit, Voith Sulzer Paper Technology rounds off its gap former spectrum and thus is the first paper machine manufacturer to offer gap former concepts tailor-made to suit all applications in the packaging paper sector, which permits producing also heavy grades with excellent quality at high speeds.

Based on the continuous increase in the quality standards demanded of top plies of packaging grades in particular with regard to printability, coverage, and whiteness with minimum basis weights, Voith Sulzer has developed a new gap former for the manufacture of top plies.

Existing former designs for the production of top plies are based primarily on conventional top wire solutions with or

Fig. 1 and 2: DuoFormer Top (pilot plant).

Fig. 3: Step Diffusor Headbox for top-layer gap former.



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without hybrid or semi-hybrid formers. They give fairly good results in terms of individual paper characteristics but are limited in terms of speed. As generally known, the profiles achieved on these formers are relatively poor compared to gap former concepts. The high formation quality demanded of top plies requires low consistencies and jet-wire ratios considerably in excess of 1.0. Only hybrid designs will deliver superior formation under these conditions.

The following aspects have been the driving forces for the development of the top-layer gap former:

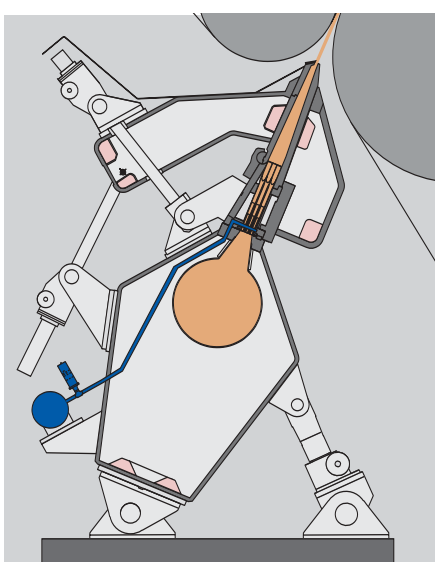
- high strength
- enhanced formation
- elimination of the speed limit
- high runability even at high speeds (> 1000 m/min)
- compact design

Sheet Forming Concept

The DuoFormer Top operates on the principle of the DuoFormer CFD, a gap former design used for the production of base plies of packaging papers. It is a roll-blade former featuring:

- single- or multi-layer headbox
- forming roll without vacuum
- jet discharge channel
- wire suction box with integrated suction transfer box
- couch-on roll.

The paper runs in the same direction as the base sheet. This means that, unlike existing former designs, the headbox is arranged with its slice facing the press section and thus the direction of paper run. Initial drainage takes place over an open forming roll with no vacuum applied. The web is further drained on the wire suction box and transferred by the outer wire to the couch-on roll and couched onto the base ply.



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Headbox

Depending on the application, a single- or multi-layer headbox is used. Its main parts are the distribution manifold, the Step Diffusor block with ModuleJet SD dilution control, and the nozzle. Apart from the general requirements placed on the headbox, a particularly important issue in the production of packaging papers is to achieve good formation at low MD/CD ratios. High-quality formation ensures superior coverage with a minimum amount of virgin fiber in the furnish. The Step Diffusor headbox has the ability to fulfil these demands.

Forming Roll

The forming roll has an open surface and is not vacuum-augmented. The drainage pressure is adjusted by the tension of the outer wire and determined by the roll diameter. The forming roll ensures safe wire support, which effectively prevents the formation of top wire ridges. Due to

Fig. 4: Jet discharge channel and wire suction box with suction transfer box.

Fig. 5: Detail from DuoFormer Top (pilot plant).

Fig. 6: Formation versus MD/CD, gap former/ fourdrinier.

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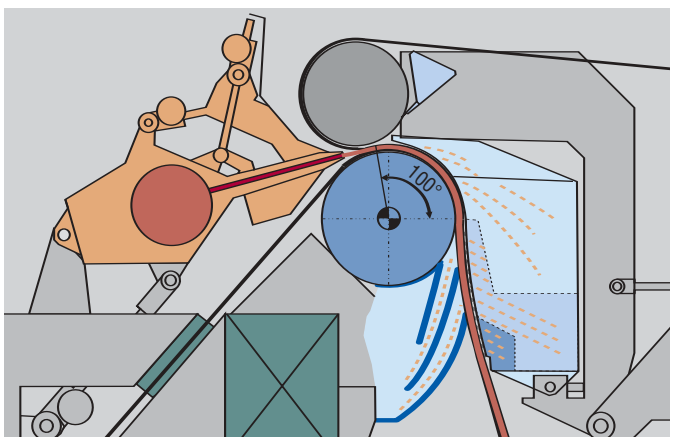

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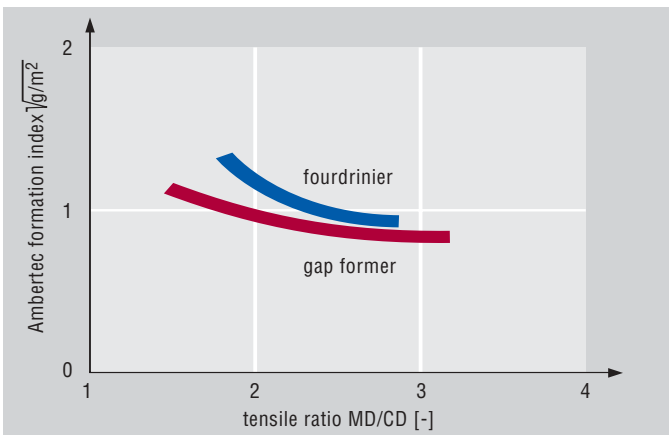

the small radius of the forming roll, the portion of the stock jet going through the outer wire separates from the wire very quickly. With other formers using a forming shoe (larger radius) as the primary drainage element, the jet stays close to the top wire longer as it travels along and there is the risk that the jet does not penetrate the top wire evenly, causing CD profile variations. Drainage on the forming roll simplifies operation, as the exact position of the jet impingement point is less critical.

Jet Discharge Channel

Arranging the headbox at the highest point of the former simplifies water flow towards the jet discharge channel. The portion of the jet going through the outer wire is captured in the channel very quickly and discharged on the drive side with minimal mist formation. In this area, jet energy and gravity are sufficient to ensure efficient drainage, it is not necessary to apply a vacuum to the jet discharge channel.

Wire Suction Box

Web drainage is continued on the wire suction box which consists of a curved shoe with 12 to 20 blades. Since the forming roll and the shoe are curved in opposite directions, the split between dewatering accomplished by the forming roll and the shoe can be optimized by adjusting the two wire tensions independently of each other. On the shoe, the drainage pressure can also be varied by adjusting the vacuum level. The suction box is divided into two suction zones, each of them supplied with a separate vacuum. The second zone enhances the drainage capacity and simultaneously forms an integrated suction transfer box which effectively transfers the web to the outer wire.

5

Couch-on Roll

Similar to conventional solutions, the web formed on the DuoFormer Top is couched onto the base ply by means of a couch-on roll. Since – due to the large couch-on roll diameter compared with the reversing roll – web liftoff can occur only at very high speeds, the problem of web liftoff is virtually eliminated.

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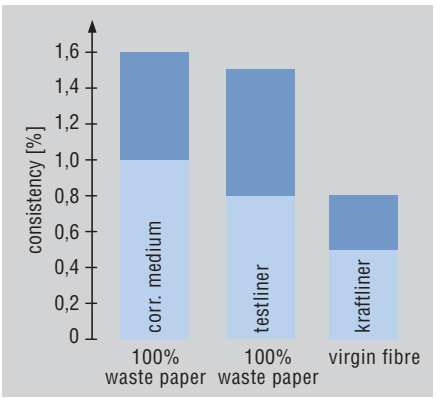

Fig. 7: Commonly used stock consistencies in different applications.
❍ Normal range.

Fig. 8: DuoFormer Top with different wrap angles.

Fig. 9: Fines distribution over sheet caliper on different former designs.

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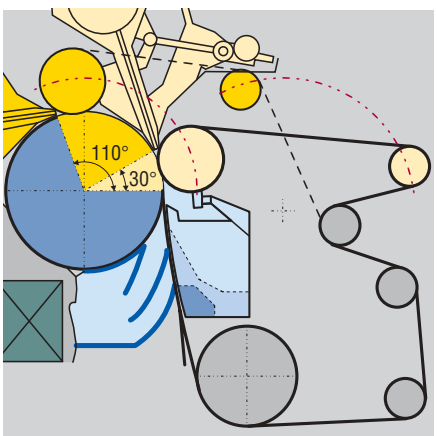

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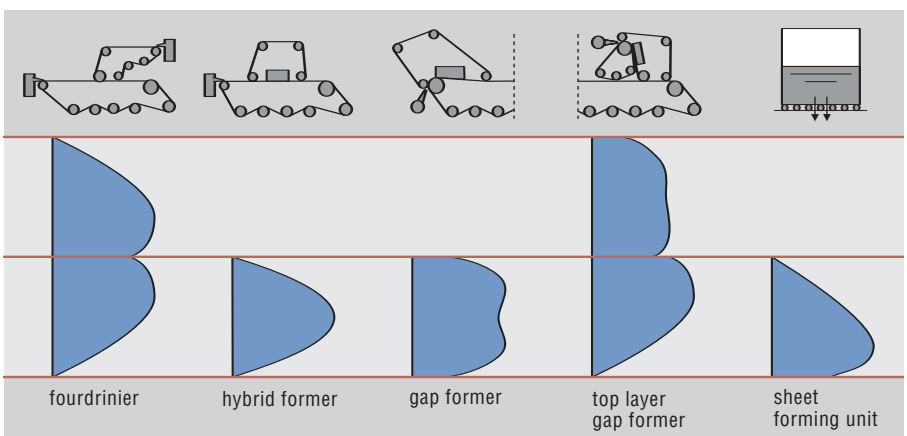

Technological Relations

Formation

Both the base-layer gap former and the new top-layer gap former with Step Diffusor headbox give good formation at low MD/CD ratios. Fourdrinier wires have to be run at large jet-wire ratios to achieve good formation values. This has a negative effect on the MD/CD ratio. On gap formers, formation is far less dependent on the jet-wire ratio than in conventional solutions. The better coverage due to better formation permits reducing the proportion of the top-ply basis weight in relation to the total basis weight. The high fiber strength potential remains unchanged.

In gap formers for the production of packaging papers the current trend – in particular with virgin fiber – is towards larger forming rolls. Good formation properties are to be achieved by using low consistencies and a small amount of blade drainage, since breaking-up of the flocs will reduce strength. In practice, a compromise has to be found between dilution (= consumption of pump power and retention) and drainage capacity (= installation cost and vacuum requirement). Basically, in gap formers and therefore also in the DuoFormer Top, larger percentages of virgin fiber require considerably lower headbox consistencies than waste paper.

At high basis weights this leads to jet thicknesses which without lateral forming gap sealing cause technologically unacceptable cross flows. Therefore, lateral sealing of the forming gap is one of the central points under development.

Due to the large range of applications, the top-layer gap former has been designed for different degrees of forming roll wrap. This permits adaptation to the different furnishes and allows increases in production with limited rebuild requirements. The DuoFormer Top will offer formation qualities similar to those of hybrid formers.

Bond strength

As generally known, bond strength depends significantly on the distribution of the fines. Bond strength has been a key issue in the design of the DuoFormer Top. Drainage towards the paper side couched onto the base sheet is very gentle to prevent washing-out of the fines. No vacuum is applied to this side *(Fig. 9)*.

It is also well-known that high stock consistencies and low jet-wire ratios have a positive influence on bond strength.

A low jet-wire ratio can readily be set on a top-layer gap former; but the use of virgin fiber puts a limit to stock consistency variation. As a whole, based on drainage to two sides, the DuoFormer

Fig. 10: Space required by various two-ply sheet forming units. Dimensions for a 5 m wide machine based on same water capacity.

Fig. 11: Applications of DuoFormer Top.

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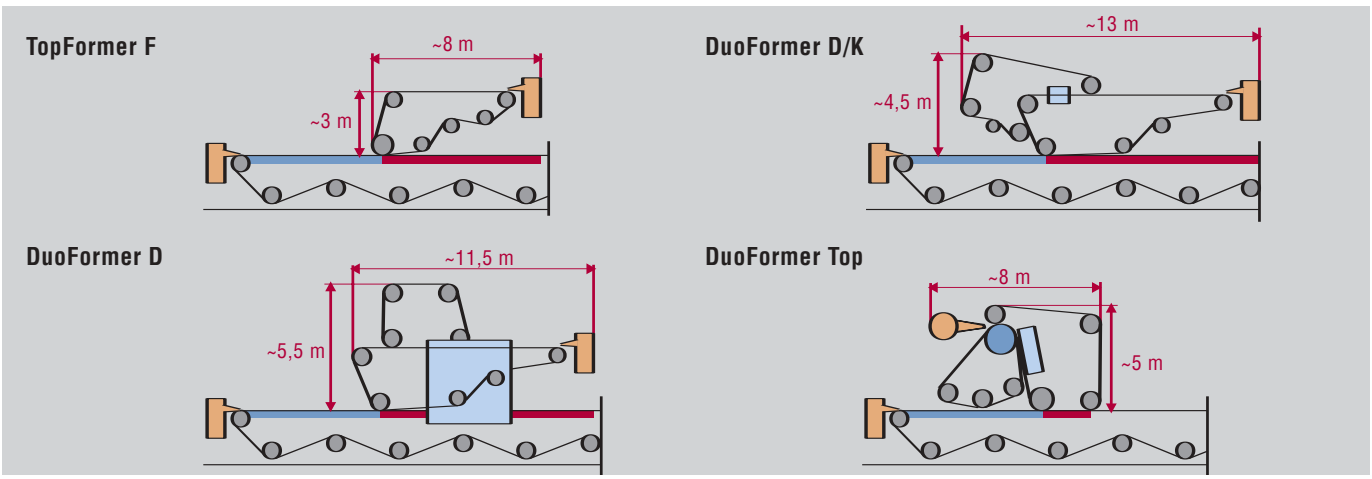

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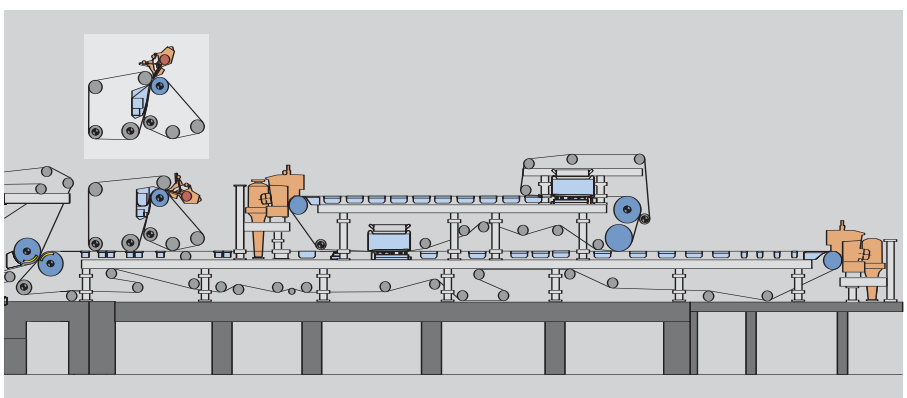

Top creates optimum conditions for good bond strength characteristics.

Multi-layer technology

The multi-layer approach of the base-layer gap former, which has become state-of-the-art technology, can be transferred to the top-layer gap former. Using the multi-layer technique, it is possible to structure the top sheet in the z-direction. Different furnishes or classified stock can be used. This helps optimize the surface properties of the top ply, for example for improving printability (top side) or for further increasing bond strength (bottom side). It is yet to be shown if the higher investment cost of a multi-layer headbox for the production of top plies is justified.

Production speed

Speed limitations of approximately 1000 m/min on fourdrinier machines or hybrid designs are eliminated by the use of a DuoFormer Top. It is not yet known what the upper speed limit of this former type will be. In practical terms this means that speed increases are no longer limited by the former. So, if a top former is to be placed onto a fourdrinier, a configuration like the DuoFormer Top will offer the best potential for the future: The technological benefits of this design are also evident at considerably lower speeds and, on top of that, when at some later time the fourdrinier is to be converted into a base-layer gap former it will turn out that opting for the future-oriented top-layer forming concept earlier has been the right decision.

Location and Impact on Machine Performance

One of the most obvious features of a multi-ply sheet forming section utilizing a DuoFormer Top is that the top-ply headbox faces the direction of the base

Fig. 12: Pilot paper machine with DuoFormer Top.

sheet. Its distance from the base-sheet headbox depends on the drainage length required for the base ply. Since the inner wire of the DuoFormer Top is arranged above the drainage section of the base ply and runs in the same direction as the base-ply wire, the space taken up by the top-layer gap former after the couching point – between the couch-on roll and the wire suction roll – is fairly small. In new plants, this reduces the length of the building. In rebuilds, it can be a decisive factor for the feasibility of the rebuild. The top ply is formed over the unfinished product. If fiber lumps, drops, or any other disturbing particles drop onto the base sheet they will be covered by the top ply.

The inner wire does not run over blades, resulting in reduced wire wear. The outer wire is longer as it runs over the vacuum-assisted wire suction box. The portion of blade drainage in top ply drainage is very small, which apart from the strength benefits also extends wire service life.

Applications

The DuoFormer Top has originally been designed for producing the top plies of packaging papers. But this new former design is basically suited for all applications in which top wires or hybrid formers have so far been used for top-ply production. So, the DuoFormer Top is also an option for the production of the individual plies of board, in particular of the top or back ply. Different angles of wrap ensure the required flexibility.

In the production of board at low production speeds, the downward water flow minimizes the danger of backflows in the forming gap.

Liner/testliner	Board
■ white top	■ top
■ mottled liner	■ under ply
■ top ply	■ filler ply

12

Outlook

To find the optimum configuration for every application, the DuoFormer Top will be available for customer trials from October 1997.

Layout data:

Basis weight:	30 - 80 g/m^2
v_b:	300 - 1400 m/min
Wrap angle:	30 - 100°

At the same time, research is under way to solve the long-existing problem of lateral forming gap sealing in gap formers to permit the use of large headbox slice openings.

It is crucial both for board and packaging papers to achieve superior formation at good strength values. This requires low consistencies and less blade-induced drainage.

The new top-layer gap former extends the speed range and thus the production range of multi-ply packaging papers based on the technological characteristics important for these products.

"ahead

Facts, trends and visions in the Board and Packaging Paper Industry:
Information meeting in Vienna from April 28 to 30, 1998

Springtime in Vienna – this has always been worth making the journey! Paperboard experts from all over Europe meet there at the end of April. But they will not be paying the city a visit merely to get to know Austria's capital from its most beautiful side during the most attractive season of the year. Instead, growth and a sense of awakening of a different kind will occupy their minds. Markets and technologies, facts, trends and visions of their trade – board and packaging paper manufacturing.

*The Paper Machinery Division Board and Packaging invites European manufacturers to attend a meeting in Vienna from **April 28 to 30**, 1998. First-hand information on the latest developments and future trends will be the main topic – backed by lectures from the research world and practical business areas, question-and-answer sessions and an exchange of views. A date worth noting!*

For more details, interested persons are welcome to contact the Paper Machine Division Board and Packaging of Voith Sulzer Papiertechnik in St. Pölten, Austria.
Telephone: ++43 2742 806 2353,
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The authors:
Matthias Wohlfahrt,
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R&D winding technology

Paper Machinery Divisions:

Winding technology for the next millennium – with Sirius

The paper industry today already demands reel diameters up to 3.80 m, which, at a machine width of 10 m, means reel weights of up to 120 tonnes.

Paper finishing processes formerly carried out offline are now being integrated into the paper machine itself. Online coating is now the rule, and online soft-calendering is no longer unusual. The Voith Sulzer Janus concept has made online supercalendering a reality at speeds up to 1500 m/min, and this has already been successfully implemented.

Due to the associated dramatic changes in paper characteristics, today's end section and rewinding concepts have reached their limits. Voith Sulzer have therefore developed an entirely new winding concept to cope with such demands. This concept was first implemented within the framework of the large-scale Triple Star project of KNP LEYKAM *(Picture above)*.

The Sirius reeling concept

The Sirius reeling concept is presented here on the basis of the new Pilot Reel at the Voith Sulzer Heidenheim R&D center for graphic papers.

In addition to the new concept, the universal and flexible design of the Pilot Reel facility allows a wide variety of winding principles to be tested and thus also basic research to be carried out.

Fig. 1: Pilot Reel – Sirius configuration.

Fig. 2: Sirius nip loading system.

Fig. 3: Pilot Reel.

Fig. 3 shows an overview of the new Pilot Reel, and in *Fig. 1* the Sirius winding concept is shown with the test rig set up for normal winding operations.

SensoReeling, the heart of the Sirius concept

The heart of the Sirius winding concept is the completely new nip loading system. In contrast to the pope reel, nip load is generated by the pivoted SensoRoll, while reel growth is compensated by the reel system *(Fig. 2)*.

The nip loading system is operated by a short-stroke cylinder to enable extremely fine adjustment of nip force. By this means, the force and travel components are separated from each other. As a result, the masses which have to be moved to apply the required nip load are kept low. This avoids errors due to friction, so that even very low nip load (down to 0.3 kN/m) can be precisely adjusted.

Since the SensoRoll is wrapped through almost 180°, the web tension and nip load are no longer linked. This means that web tension fluctuations can no longer affect the nip load.

The Pilot Reel allows nip loads to be applied either by conventional means or according to the Sirius concept. Loading can either be hydraulic or pneumatic, allowing differences in operating behavior runnability to be investigated.

In the Sirius concept the reel spool generally has a center wind, but conventional winding systems can also be set up on this Pilot Reel. This combination of innovative nip loading system with center wind of the reel spool and web tension enables optimal control of reel structure during winding.

The entire winding process, i.e. interplay between web tension, nip load and torque (center wind) is controlled by a computerized reel hardness monitoring system: the Voith Sulzer Rollmaster. This system also keeps statistical records of all main parameters.

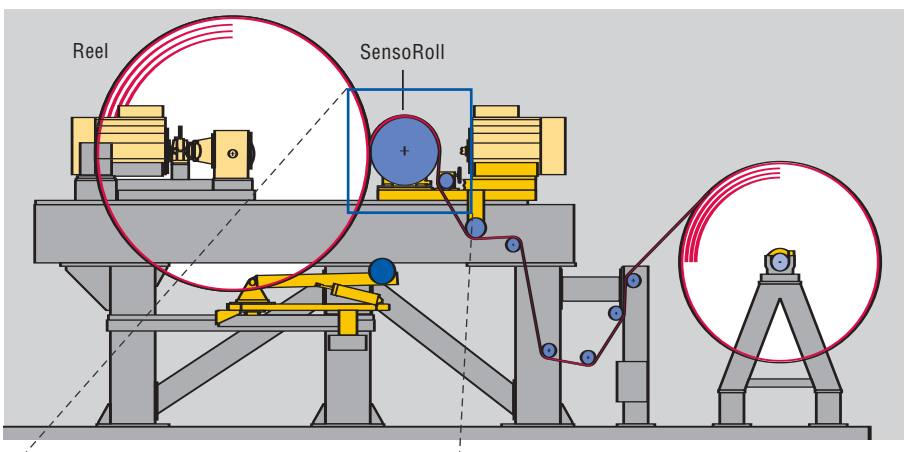

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Fig. 4: Strip pull-out test recorder chart.

Fig. 5: Principles of the strip pull-out method.

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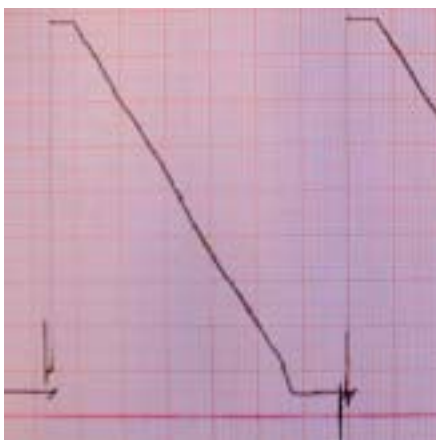

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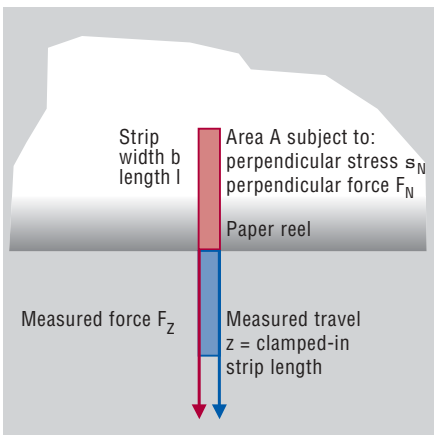


The design speed of the Pilot Reel is 3000 m/min, with a maximum reel width of 2.50 m at 2.20 m diameter. In specific cases the rig can easily be converted for reel diameters up to 3.50 m.

Reel changing systems

The Pilot Reel is designed so that all known reel changing concepts can be implemented.

One of the main development goals is to implement new winding concepts for:

- perfect winding right from the first layer
- minimum paper broke
- optimum reel changing reliability.

To this purpose, a modern high-speed camera allows detailed analysis of all web movements.

New tools for improved winding

To gain a deeper knowledge of the winding process, further tools have been procured or developed in addition to the new test facility. These are described below.

Measuring radial wound-in tension

Since conventional measuring methods for assessing winding structure were inadequate, Voith Sulzer applies a method of measuring the actual radial tension wound into the reel. As winding proceeds, a paper-covered steel tape is inserted into the nip between reel and reel drum at several diameters. When this tape is pulled out afterwards, the force is plotted versus distance as shown in *Fig. 4.*

This measuring method is based on the principle shown in *Fig. 5.*

The following equations apply:

$F_Z = \mu 2F_N$

where $2F_N$ takes account of forces acting from above and below on the tape

$\sigma_N = F_N/A \rightarrow \sigma_N = F_N/b\,z$

As shown by the recorder plot, force is linear to travel: $F_Z = c\,z$.

The radial winding tension is thus defined as:

$$\sigma_N = F_N/A = \frac{F_Z}{2\mu b z} = \frac{cz}{2\mu b z} = \frac{c}{2\mu b}$$

This means that to determine the radial tension, it is only necessary to measure the gradient of the force/travel line on the recorder plot, the coefficient of friction μ between paper and steel (for this configuration measured with μ = 0.3) and the tape width.

As shown in *Fig. 12,* the tape pull-out method enables clear assessment of winding hardness, irrespective of edge face quality (important for the needle test method) and without interrupting the winding process (as required with the Parotest).

Reel winding structure simulation program

Together with a university institute, Voith Sulzer is developing a simulation program for prior assessment of paper reel winding structure. Using the finite element method and non-linear algorithms for paper characteristics, this program computes the 3-dimensional reel structure from the winding torque, web tension and nip load. It takes account of dead weight and centrifugal forces, air inclusions and layer displacements.

This simulation model thus defines the winding structure much more accurately than methods used so far, some of which

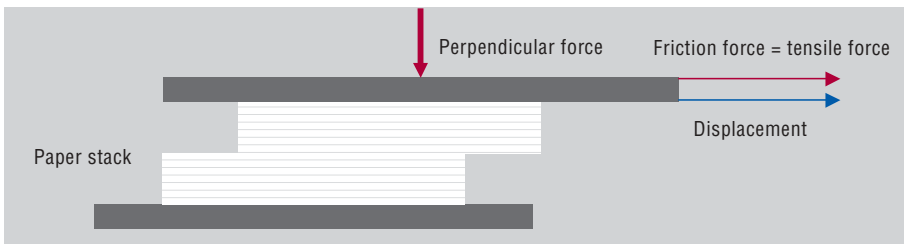
Fig. 6: Principle of friction measurement.

Fig. 7: Friction measurement results. Force displacement plot for uncalendered LWC.

oversimplify the formulation of basic physical effects.

First results with this simulation program indicate that the target of forecasting paper reel winding structure can be reached effectively.

Paper grades naturally vary very widely, not only with regard to standard values such as basis weight, caliper and density, but also surface characteristics, compressibility, strength and rheology. Since particularly the latter characteristics strongly affect winding structure, and hence computation results, these values are carefully measured by appropriate methods.



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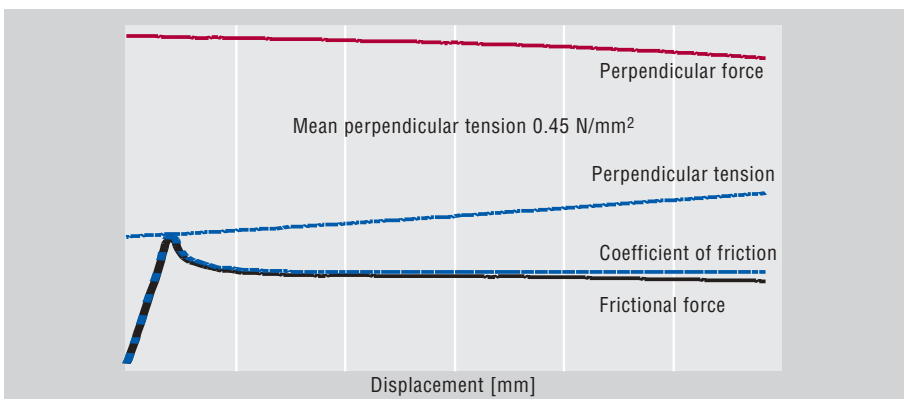

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Determination of winding friction values

For this purpose we use an instrument which measures coefficients of friction at the high tensions occuring during the winding process. This instrument was developed by converting a tensile strength testing device so that it measures friction, perpendicular force and displacement.

The measuring principle is shown in *Fig. 6. Fig. 7* shows the results obtained on uncalendered LWC. Plotted here versus displacement are the perpendicular and frictional forces, the intersurface pressure calculated from displacement and perpendicular force, and the coefficient of friction derived from perpendicular and frictional forces. As shown, static friction first has to be overcome according to Coulomb's law before dynamic friction commences. The perpendicular tension increases during measurement because the paper surface area under pressure decreases with increasing displacement.

The wide variation of coefficients of friction according to paper grade is clearly shown by comparing results between uncalendered and calendered LWC. In *Figs. 8 and 9,* coefficients of static and dynamic friction are plotted versus perpendicular tension for these two grades.

Both static and dynamic friction are significantly higher with uncalendered than with calendered LWC. Furthermore, the static and dynamic coefficients of friction are much wider apart for uncalendered LWC. The coefficient of friction for calendered LWC is clearly unaffected by perpendicular tension variation *(Fig. 9),* whereas it varies considerably with uncalendered grades, not only LWC. As shown in *Fig. 8,* the coefficient of friction at very low perpendicular tension is significantly higher than at the high perpendicular tension in the reel during winding. For this reason, relevant paper friction coefficients in winding technology must be measured at perpendicular tensions of 0.4 N/mm^2 and above.

Compression measurement

The compression characteristics of paper likewise have a strong influence on winding structure. To check this, we converted a Ring crush tester to enable com-

Fig. 8: Coefficient of friction versus perpendicular stress for uncalendered LWC.

Fig. 9: Coefficient of friction versus perpendicular stress for calendered LWC.

Fig. 10: Compression test setup.

Fig. 11: Compressibility comparison between calendered and uncalendered LWC.

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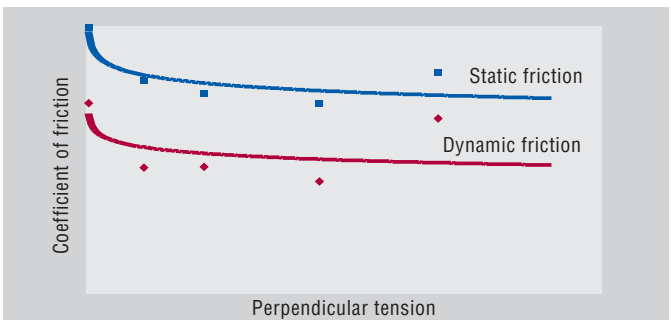

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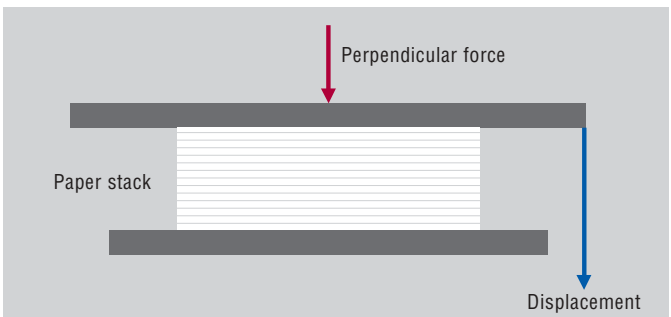

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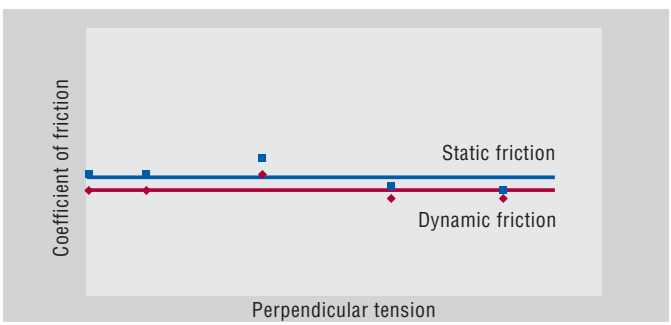

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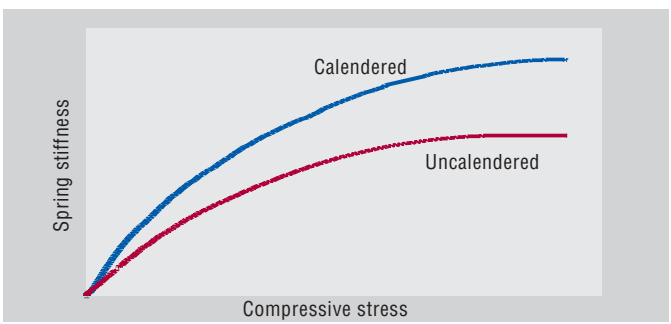

pressibility measurements to be carried out. As shown in *Fig. 10,* the basic principle is to measure perpendicular force as a function of increasing displacement.
In *Fig. 11,* compressibility tests are compared between calendered and uncalendered LWC by plotting spring stiffness of the paper versus perpendicular tension. The calendered LWC is much stiffer – i.e. less deformable – than the uncalendered grade. CD-profile irregularities in calendered paper therefore have a much stronger effect on nip force regulation, and hence on winding structure.
With these tools and the results derived obtained, Voith Sulzer have gained a better understanding of winding processes. This forms a solid basis for formulating material characteristics in the 3-dimensional simulation program.

Results

In the meantime, numerous tests have been carried out with various paper grades. Calendered LWC can be wound troublefree at speeds up to 2000 m/min, and uncalendered LWC up to 3000 m/min. Thickly coated decorative papers, where the slightest displacement can lead to glossy zones, were wound and rewound several times without any problem. Even self-copying paper – where troublefree winding has only been possible without a nip up to 800 m/min – can now be wound at speeds up to 1500 m/min with enhanced reel quality.
In summary, this concept not only allows higher winding speeds, but also results in outstanding reel quality.

Winding tests

The following selection of winding test results give a good impression of how the Sirius concept improves reel structure.
Fig. 12 shows the effect of reel center torque on winding hardness (at constant nip load), expressed as radial winding tension versus reel diameter.
Winding torque is clearly a very effective parameter for controlling winding hardness. The corresponding center torque curves are plotted versus reel diameter in *Fig. 13.*

Fig. 12: Effect of reel center torque on winding hardness and constant nip load.

Fig. 13: Reel center torque curves.

Fig. 14: Effect of nip load on winding hardness at constant torque.

Fig. 15: Nip load curves.

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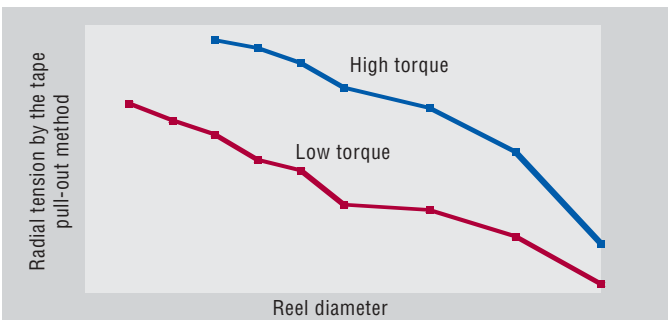

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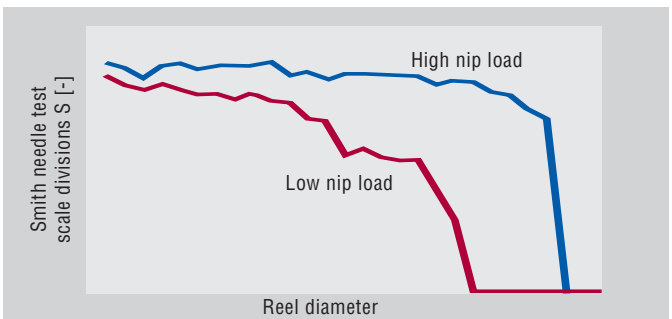

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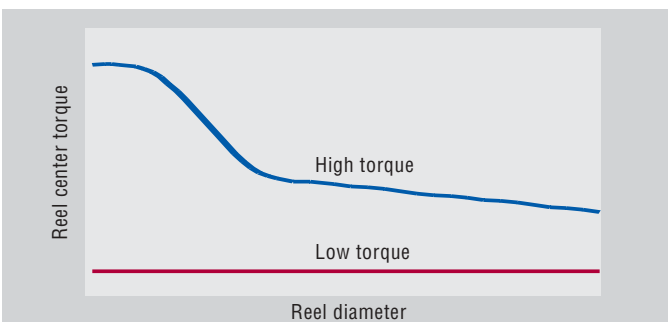

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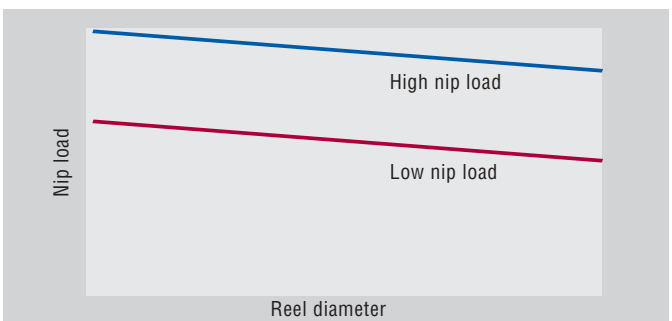


The influence of nip load on winding hardness (at constant winding center torque) is shown in *Fig. 14,* where winding hardness in increments S of the Smith needle test scale are plotted versus reel diameter.

Likewise nip load is therefore an effective parameter for controlling winding hardness. The nip load characteristics used here are shown in *Fig. 15* as a function of reel diameter.

Reel winding structure can thus be controlled very effectively by varying both the winding center torque and the nip load between paper reel and reel drum. The best possible way to ensure optimal winding structure is therefore to combine these control parameters.

Summary

The new Voith Sulzer Sirius concept meets all foreseeable demands on winding technology.

Thanks to the following features, higher winding speeds are possible, and in addition to this, the results are also better:

- Reel center wind
- SensoRoll acts as loading system
- Decoupled loading and displacement are provided by two carriages
- Full-length nip load system with no transfer from primary to secondary zone.

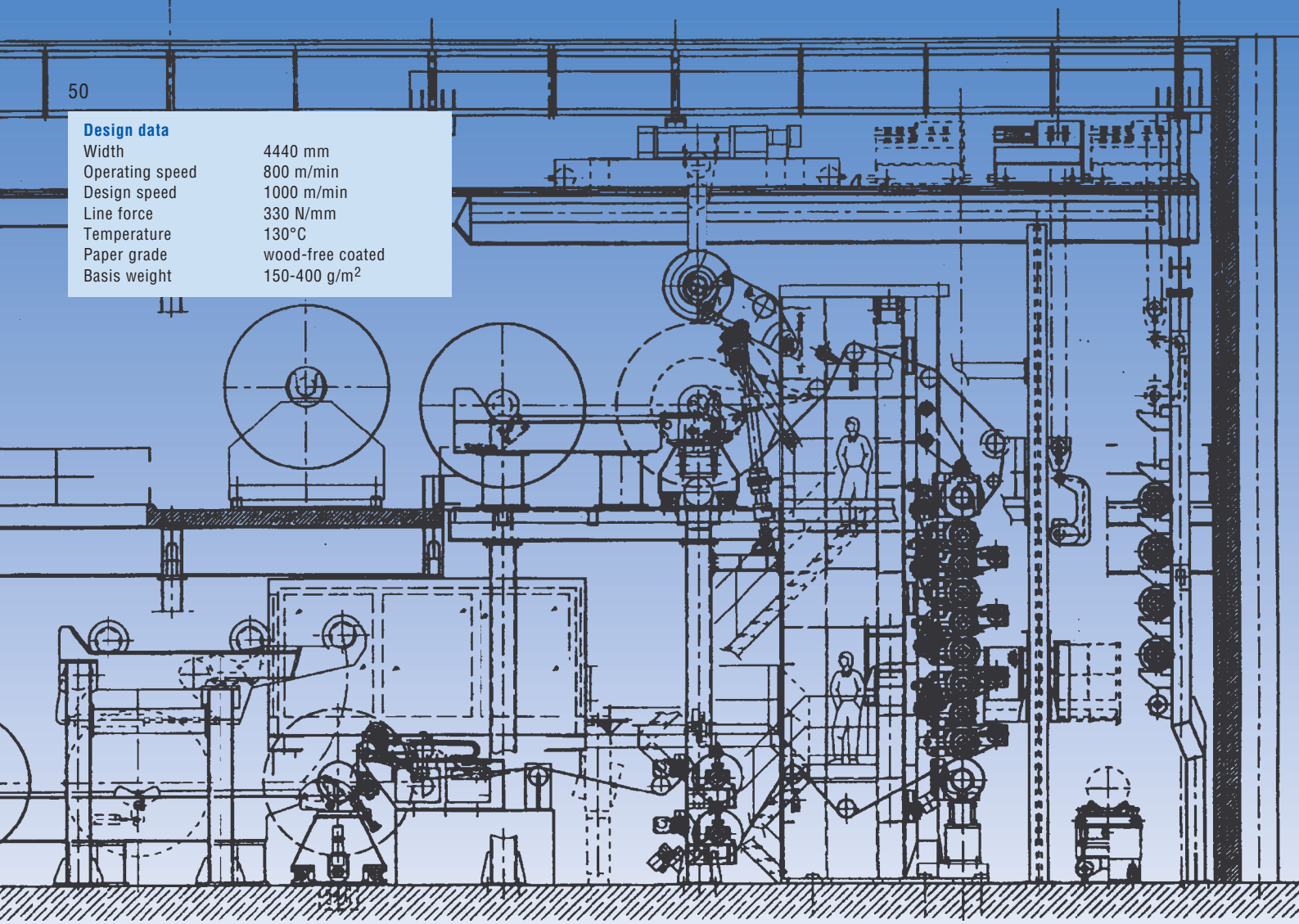
Large reels up to 3.80 m diameter weighing up to 120 tonnes can be handled easily. Calendered papers can be wound trouble-free at speeds of 2000 m/min, uncalendered grades up to 3000 m/min. Even highly sensitive grades such as self-copying (carbon) papers can be wound at higher speeds and with enhanced quality. Due to improved reel changing, broke is reduced.

With the Sirius winding concept and our new R&D tools, we can work out optimal operating parameters for the papers of our customers.

A simulation program using much more comprehensive algorithms and models than previously is currently under development. In future this will allow 3-dimensional forecasting of paper reel winding structures.

Design data

Width	4440 mm
Operating speed	800 m/min
Design speed	1000 m/min
Line force	330 N/mm
Temperature	130°C
Paper grade	wood-free coated
Basis weight	150-400 g/m^2



1

Finishing Division:

Startup of the first Janus calender at KNP, Maastricht, the Netherlands

The author: Franz Kayser, Productmanagement, R&D, Finishing Division

The elements and technological principles of the Janus concept have been described in many publications and papers. And since the Janus technology centre was opened, hardly a week has gone by without at least one test demonstration on customer's paper to show the quality and output advantages of the Janus concept.

Table 1		**Supercalender**
Lehmann gloss	[%]	73,7/76,8
Bekk smoothness	[sec]	1468/877
Roughness PPS-10S	[❍m]	1,06/1,09
Brightness/Y-factor	[%]	85.84/85.60
Basis weight	[g/m^2]	250
Thickness	[❍m]	190
Specific volume	[cm^3/g]	0.760

Fig. 1: Offline Janus calender.

Fig. 2: Steam boiler.

Fig. 3: Heating rolls.

Fig. 4: Calender unwind system.

What has been missing so far, however, is an actual production report. This article remedies the situation by reporting on the first Janus calender startup at KNP Leykam, Maastricht.

Fig. 1 shows the calender layout in this mill, for finishing wood-free multicoated heavy grades to optimal gloss.

The supercalender used so far only achieved the surface qualities shown in table 1, at speeds down to 300 m/min.

This Janus calender at KNP Leykam comprises the following modular elements:

1. Janutec plastic rolls for all elastic roll position
2. Direct steam-heated rolls with individual temperature control
3. Multizone Nipco top roll
4. Single zone Econip bottom roll
5. All hard rolls coated (partly chromed, partly with SUMEcal)
6. Web rope loading system, thus eliminating the nip guards
7. Cooling rolls in calender output
8. Unwind system with flying splice
9. Sensomat Plus rewind system.

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For PM 6 in Maastricht, two of these Janus calenders were supplied.

Since Janus technology was so new, and never used so far in production, it was agreed with KNP Leykam that the calender would be commissioned well before startup of the rebuilt PM 6.

After the usual hectic procedures, e.g. for balancing heating loops and drive motors, the first Janus calender went on line during the evening of October 21, 1996. The situation looked so promising that it was decided to calender the first production reel on the next day.

At 6 a.m. on October 22, 1996 the steam boiler *(Fig. 2)* was fired up, bringing the heating rolls *(Fig. 3)* to 140°C. All rolls were then cleaned again, and finally the web was threaded through the open calender nips to the winding station.

Fig. 5: Temperature measurement with IR camera.

Fig. 6: Gloss development in the Janus calender.

Fig. 7: Winding on the Sensomat Plus.

Fig. 8: Gloss measurement in the sample test laboratory.

5

After having the web wrinkle free on the Sensomat Plus roll, all nips were closed and pressurized.

The calender was then run up to 400 m/min – 100 m/min faster than the previous supercalender. In the meantime, this speed has been increased still further to 700 m/min, with equally good calendering results.

With a specially equipped infra-red temperature camera, the high-gloss hot rolls *(Fig. 5)* were continuously monitored for correct temperature level and distribution.

The same procedure was adopted for all other Janus elements, supervised by specialists in order not to lose any time. *Fig. 6* shows the result: a wonderfully uniform gloss from nip to nip of the Janus.

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Fig. 9: The proud team in front of the first Janus-calendered paper reel.

This high gloss paper, extremely smooth and difficult to wind, is handled without problem by the Sensomat Plus winding system *(Fig. 7)*.

Eager to see if such excellent first impressions would be confirmed in the laboratory, the customer lost no time in checking paper samples *(Fig. 8)*. The laboratory test results are shown in *Table 2*.

Not only was calendering considerably faster, with substantial improvements in gloss and smoothness, but above all systematic application of the Janus principle resulted in extremely low 2-sidedness.

Compared with 3-4 points gloss difference between the two sides on the supercalender, 2-sidedness on the Janus calender amounts to only 1 point.

Table 2		**Janus 13/14**	**Supercalender 9/10**
Speed	[m/min]	700	300
Line force	[N/mm]	300	300
Temperature	[°C]	100	90
Nips		9	11/13
Lehmann gloss	[%]	77,6/78,1	73,7/76,8
Bekk smoothness	[sec]	1675/1711	1468/877
Roughness PPS-10 S	[❍m]	1,12/118	1,06/1,09
Brightness/Y-factor	[%]	86,31/86,20	85,84/85,60
Basis weight	[g/m^2]	250	
Thickness	[❍m]	190	
Specific volume	[cm^3/g]	0,760	

At the end of this memorable day, no wonder the entire calender personnel proudly had their picture taken in Janus T-shirts with our commissioning engineers *(Fig. 9)*.

The customer was delighted with results: all calendering quality targets had not only been reached but even exceeded – at higher operating speeds.

9

Service Division:
After-market service saves fiber lines

The author:
Mark Tayler,
Service Division, USA

1

Domtar, Potlatch Mills Use Service Provider Know-How for Pressure Washer Drum Replacement

In the early 1990s pressure washers were reintroduced in North America as a cost effective way to increase production. Pulp would be washed in an enclosed vessel, thus able to wash faster and more efficiently. Pressure washers were offered in huge sizes to make them even more attractive.

At first, the washers worked very well. Operating at high rotational speeds and throughput, customers were satisfied with ROI. Unfortunately, after about two years, structural problems developed in some of the washers. The washers began to experience severe fatigue cracking, causing long down times and expensive "patch-up" work. Some failed catastrophically. Over 100 of these pressure washers were built throughout the world.

Partnership for a Solution

Domtar Inc. has a fiberboard mill in Red Rock, Ontario. The mill has sought to at least achieve some economies of scale by installing a large pressure washer. The washer performed well for a year or so, but maintenance and inspections began to uncover stress fractures. Operational problems took down the line. A solution was required, since the mill faced further investment need in effluent treatment and other areas of the mill. Domtar needed an innovative, fast solution.

Their supplier of after-market service of thick stock pumps and other pulp equip-

Fig. 1: Pressure washer 4m x 11m.

Fig. 2: Pressure washer under construction at Tristar.

Fig. 3: Pressure washer ready for shipment to Potlatch.

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ment, Tristar Industries Ltd. of Vancouver, B.C., offered a solution using a unique relationship it had established recently.

Tristar has been working with Dr. Mohamed S. Gadala at the University of British Columbia's Mechanical Engineering Department for a year or so on new ways of using Finite Element Modelling to solve complex engineering problems. Tristar would use their own know-how on pulp washer design together with their work with UBC to solve the pressure washer drum problems. Domtar agreed and a project was born.

Using Finite Element Analysis

The finite element method is a numerical analysis technique for obtaining approximate solutions to a wide variety of engineering problems. UBC uses the NISA finite element analysis (FEA) package. To develop the new drum, approximately 20 intermediate designs were considered and 60 detailed models were constructed at UBC's Finite Element Modelling Laboratory.

Once the design concept was finalized, Voith Hydro in Pennsylvania remodelled the drum using the ANSYS FEA package

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Fig. 4: Alternating stress summary for the existing design.

Fig. 5: Alternating stress results of the new drum design.

Existing Design

Location	Description	Stress* MPa (ksi)
h1	shaft/hub intersection	110.3 (16)
h3	shaft shoulder/ hub plate weldment	68.9 (10)
s1	spoke/hub intersection	54.5 (7.9)
s2	spoke/box intersection	38.6 (5.6)
d1	deck shell	17.2 (2.5)
l1	longitudinal members	32.4 (4.7)
f1	fly-rings	40.7 (5.9)

New Design

Location	Description	Stress* MPa (ksi)
h1	journal/flange intersection	81.4 (11.8)
e3	end-plate/ hub weldment	18.6 (2.7)
w1	end-plate/ web plate weldment	22.1 (3.2)
w8	web/box intersection	13.8 (2.0)
d1	deck shell	17.2 (2.5)
l1	longitudinal members	13.1 (1.9)
f1	fly-rings	27.6 (4.0)

**Reported stresses are un-averaged von-Mises intensity for level 5 torque, 129 kN.m (1,141,000 lb.in.)*

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to cross check and develop sub-models to fine tune the design in sensitive stress areas such as weld access holes ("mouse holes") and stiffness transition regions.

Building the New Drum

Domtar, U.B.C. and Tristar worked together on the problem drum during the design process. The team brain stormed potential solutions and physically measured all boundary conditions. Load cells and pressure sensors were installed on one washer during a mill shutdown to allow accurate measurement of all forces on the drum.

Tristar has been a provider of after-market services for pulp equipment since 1974. The company has always rebuilt thick stock pumps, low and high pressure feeders, make-up liquor pumps, top separator screws and baskets, and vacuum drum washers.

Much of the company's vast manufacturing resources were concentrated on the Domtar project, including the latest in CNC boring machines, lathes and critical inspection work. Just six months after the model and testing were complete, Tristar was installing the new drum at the Red Rock mill.

The new drum design has significantly reduced the alternating stress levels. In the critical first weld near the drive journal, stresses were reduced from +/-10 ksi to +/- 2.7 ksi. (The design basis values used by Tristar are +/-4.5 ksi for full penetration weldment and +/-10 ksi for non-welded parent metal.)

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Fig. 6: NISA Finite element alternating stress summary – end component detail for new Tristar drum design.

The Results

In order to relate the alternating stress levels to equipment life expectations, crack propagation analysis was employed. Although this part of the analysis is somewhat crude, on a comparative basis it provides a very reasonable tool to assess the life expectancy impact on a reduction of alternating stress levels. By using the material properties of 316L stainless steel in black liquor and assuming an elliptical surface crack, the impact of reducing the alternating stress from +/- 10 ksi to +/- 2.7 ksi was comparable to increasing the drum life from 9 months to 90 years respectively.

To verify the accuracy of the finite element analysis, the Domtar drum was fitted with strain gauge rosettes mounted on the end plate at a critical stress area.

The strain gauges were carefully protected with layers of foil and rubber laminated in place. Wiring was run through the idle journal to a rotary electrical connec-

Service Center Tristar

- A world class aftermarket equipment manufacturing and reconditioning facility providing innovative and responsive service to pulp and paper mill customers. One of Voith Sulzer's five Service Centers in North America
- Located in Delta, British Columbia/Canada
- Under the stewardship of Ray Hall, Chairman of the Board
- The leadership team:
  Samuel A. Young – President
  Mark Tayler – Vice President Operations
  Victoria Gochuico – Financial Controller
  Marcos Ishii – Sales and Marketing Manager
  Moe Kassam – Manager of Engineering and Quality Assurance
- The product lines:
  include washer drums, thick stock pumps, and digester chip feeders.
- The market:
  50% Canadian mills, 49% United States mills and 1% New Zealand and Australian mills.

Fig. 7: Fatigues cycles of the existing and new Tristar design.

Fig. 8: Measured alternating stresses on Domtar prototype drum during field verification.

Fig. 9: Rauma washer distribution by global region.

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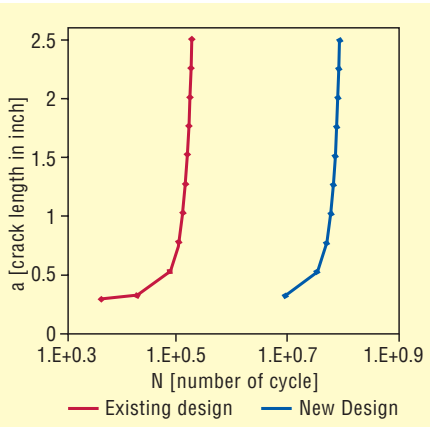

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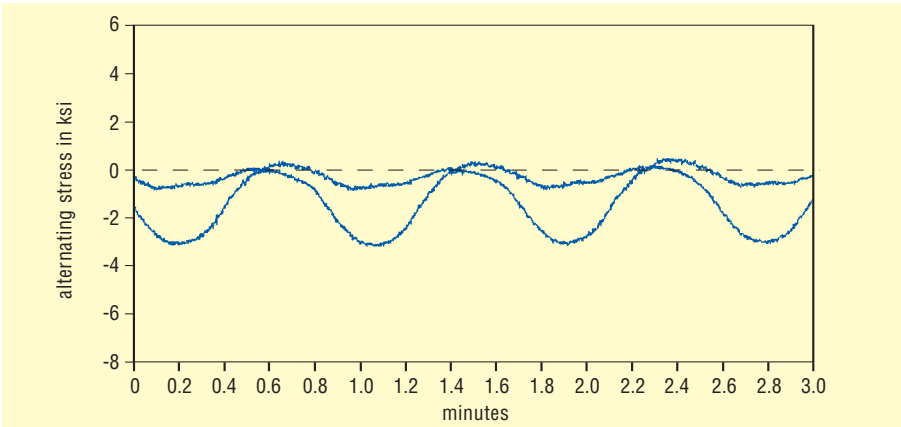

tor and fed through a data acquisition system to a computer monitor for real time viewing by the team The actual level observed was +/- 2.5 ksi – exceeding expectation for alternating stress.

The three drums shipped to Domtar have been running well. No unscheduled down time has been recorded. Tristar and Domtar continue to monitor the drums' structural performance by making spot inspections.

Repeating Success

Tristar built on its Domtar success with another of its after-market service customers – Potlatch Corporation at their Lewiston, Idaho mill.

Potlatch also experienced reliability problems with their pressure drum washer line. Six months after the Domtar project completed, Tristar was awarded a project with Potlatch for two even larger drums.

The Domtar drums measured 3.5 m in diameter and 8.0 m face length. The

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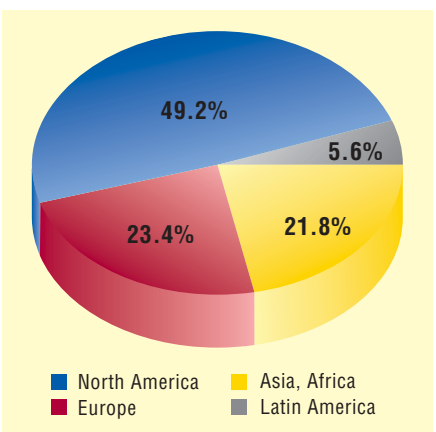
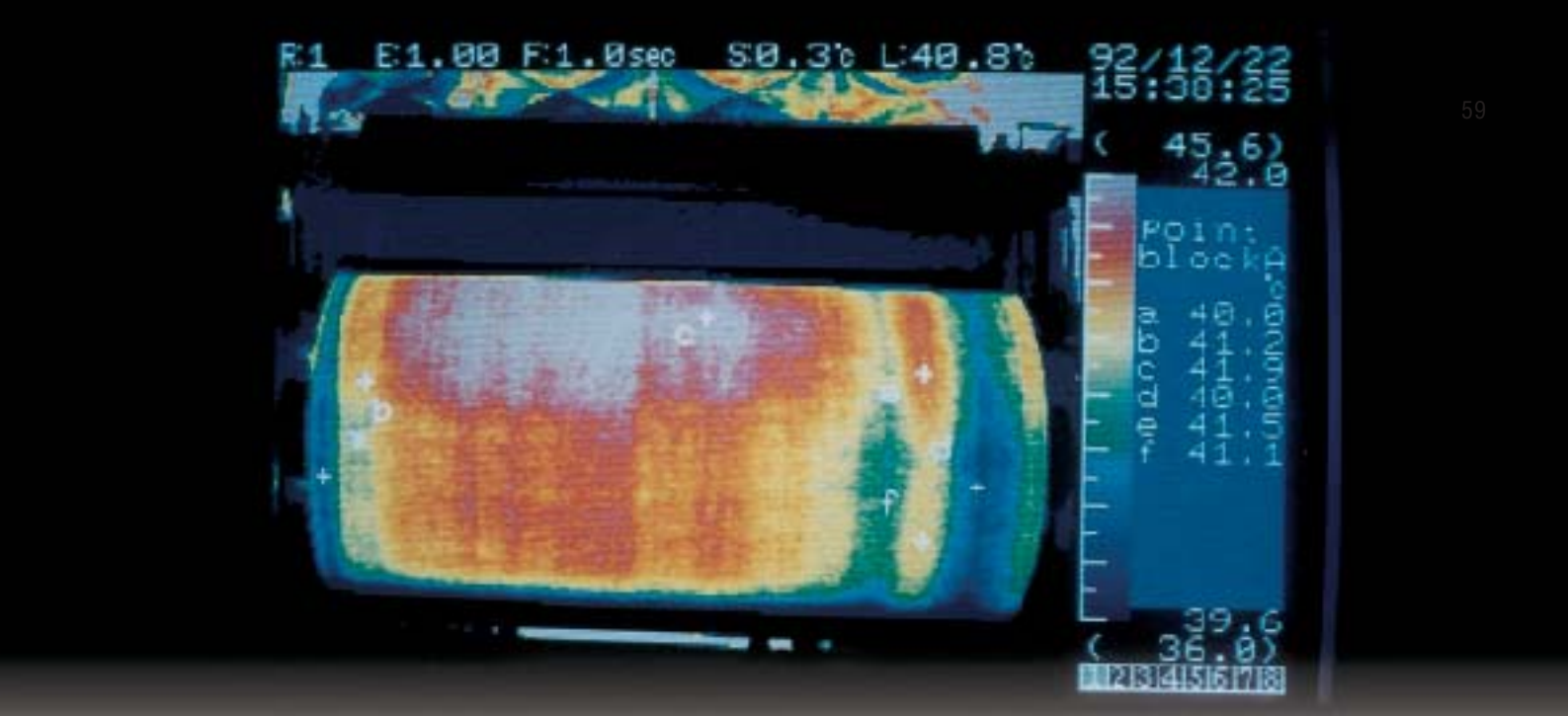


Potlatch drums were considerably larger – 4.0 m x 11.0 m. The scale up design required a concerted effort in modifying the models and subsequent design.

The Next Challenge

Implementation of the "Cluster Rules" will force mills to eliminate emissions. Today's rotary drum vacuum washers currently vent gas. The new laws will require mills to collect and scrub these gasses before emitting them to the atmosphere. Because of the high volume of gas and low concentrations of the contaminants, re-tooling mills with scrubbers is cost prohibitive. Pressure washers provide a solution. Tristar, which is a subsidiary of Voith Sulzer, has applied for and received patents in the U.S. and Canada for their new technology.

Because of their enclosed operation, pressure washers emit very little gas. Their designed throughput is excellent and washing efficiency is very good compared to conventional rotary drum vacuum filters. Replacement of rotary drum vacuum washers with pressure drum washers would eliminate air quality problems for the mill, while paying for the project with increased production.



1

Service Division:

Measurement and diagnostics join the team with DIAG S.A.

The authors:
Andreas Arnhold,
Measuring and Diagnostics Service,
Henry Giroud,
DIAG S.A.

What seems to be the trouble? Production problems, excessive vibrations? Is your dryer section energy consumption too high? Or perhaps you simply need to optimize paper machine operation? Whatever the case, troubleshooting and optimization both demand precise measurements – a speciality of the Voith Sulzer Measurement and Diagnostics Service. With their impressive range of equipment, our experts are ready for all eventualities.

As all boy scouts know, lending a helping hand means being prepared. No sooner said than done: the Voith Sulzer Service Division promptly acquired a majority holding in DIAG S.A., a French company with headquarters in Grenoble. This not only augments our human resources, but also places more equipment at our disposal. And in particular, we can now look much better after our south-west European customers. DIAG S.A. was founded in 1993 by the Centre Technique du Papier (CTP), Grenoble. Its purpose right from the outset was to provide diagnostics services for paper mills, draw up reports and make proposals accordingly. The DIAG team has thus accumulated a wealth of process and product know-how which is highly estimated by numerous paper mills.

The Voith Sulzer Service Division measurement and diagnostics teams can thus provide paper mills with valuable support in all areas, irrespective of product. This includes mechanical, thermodynamic and hydraulic system troubleshooting, production optimization and preventive maintenance.

In order to carry out today's widely varied and often complex measurement assignments, portable data reading and processing computers are used exclusively.

Fig. 1: Thermographic view of reel temperature distribution over machine width.

Fig. 2: For taking measurements inside a dry section, heat-proof suit is required.

Fig. 3: Telescopic arm with sensors for measuring pocket humidity and dryer surface temperatures over machine width.

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With those multichannel computerized measuring systems, all main data can be measured at various machine settings (e.g. at different speeds and throughputs) without significantly interrupting production.

Apart from sophisticated measuring and diagnostics equipment, we also possess comprehensive know-how for drawing conclusions from results and making recommendations accordingly, for example with respect to:

- Increased efficiency.
- Quality optimization.
- Environmental protection.

Together with our new partner DIAG, Voith Sulzer Paper Technology can now offer even better services with regard to thermal energy management in paper mills:

- Analysis and proposals for enhanced paper quality and drying.
- Energy optimization in the dry section.
- Improvement of dryer section evaporation performance.

A case study

For diagnosing humidity profile problems, for example, the Voith Sulzer Paper Technology/DIAG specialists have the latest troubleshooting equipment at their disposal – sophisticated technology specifically designed for this application.

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A thermographic analysis is first made of temperature distribution on the reel in the cross-machine direction *(Fig. 1)*, since an unequal temperature distribution indicates a non-uniform humidity cross-profile. If the problem is verified in this way, other measurements are then carried out in the dry section – a job for which our service technicians often have to wear heat-proof clothing *(Fig. 2)*. CTP has developed a special telescopic arm for this task, with sensors for measuring pocket humidity and roll surface temperatures *(Fig. 3)*.

After carrying out dry-section measurements in this way and optimizing air circulation as a result, production outputs have been increased by about 4% – apart from significant improvements in basis weight and reel humidity cross-profiles.

Examples like this show impressively how we reach our goals: to help mill owners optimize production, reliability, maintenance and cost-effectiveness. We do this with customized diagnostics techniques based on comprehensive paper technology know-how. With DIAG as our partner, the Voith Sulzer Service Division has intensified their activities as mechanical troubleshooter and as technological problem-solver.

Tissue on the upsurge

The authors:
Rudolf Greimel, Andritz AG, Graz;
Dr. Martin Tietz, Voith S.A., São Paulo

The demand for tissue – as a collective term for lightweight sanitary papers – is growing worldwide at above-average rates, bringing in its wake a growing demand for production machinery. Although this growth refers to quantities, it is above all quality which is required. Quality with tissue mainly means softness combined with strength, but it also means high volume, good water absorption, and brightness. Even the recycled materials content affects buying decisions these days. No other product sells itself on the shelf like tissue paper.

The tissue market worldwide

Global tissue consumption has been rising at 4.5% p.a. over the last eight years, as against 3.5% for other paper grades *(Fig. 1)*.

There are considerable variations in this development from region to region; for example in North America the annual rise is only 2%, while in Asia it is more than 7% and even reaches 10% in China. At nearly 5%, Western Europe is slightly above the world average.

Fig. 1: Annual production growth.

Fig. 2: Global tissue market: consumption to growth ratio in various regions.

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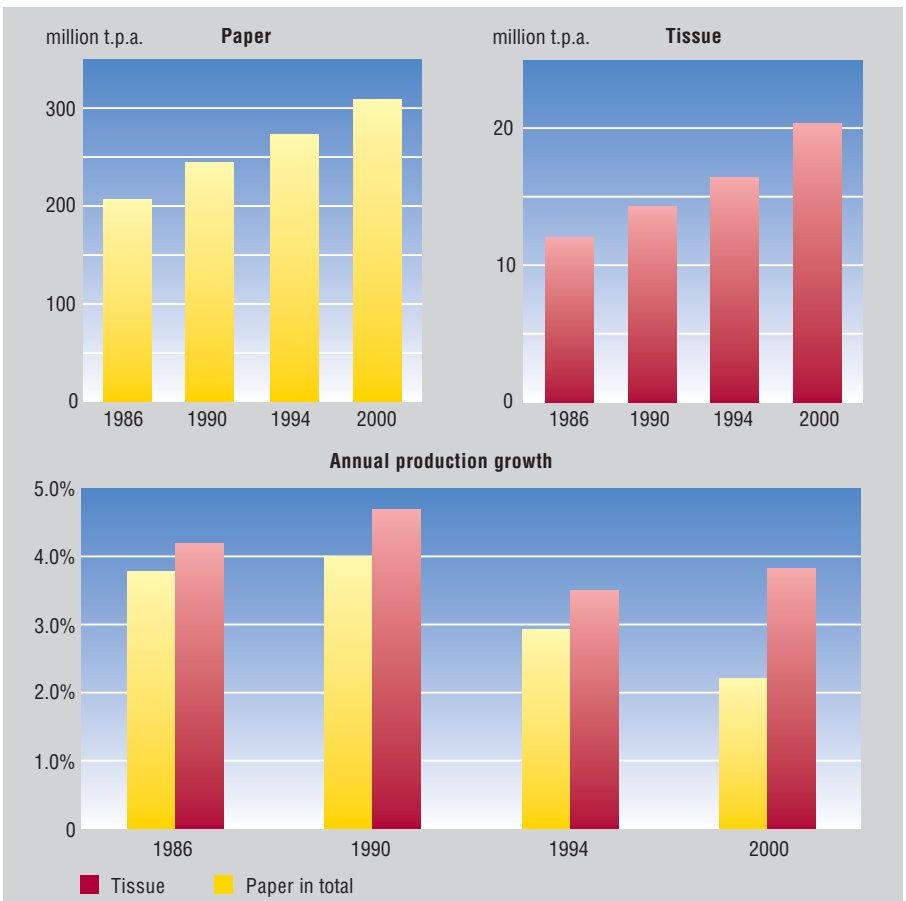

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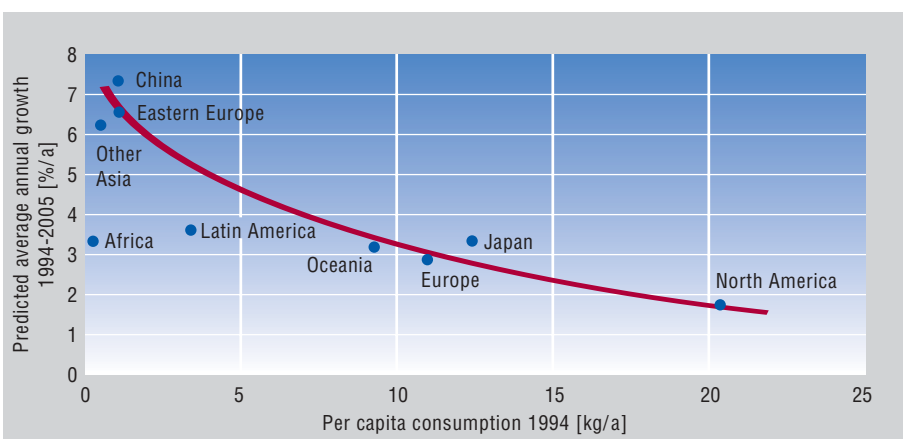


For the coming years experts expect similarly high growth rates, with greater regional differences. The higher the market saturation, the lower the relative growth rates *(Fig. 2)*.

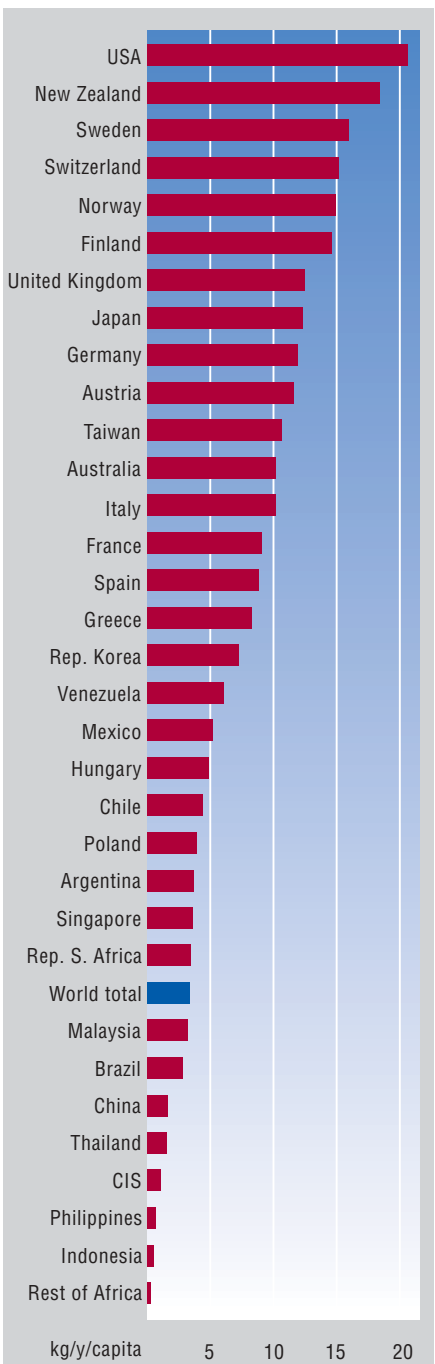
Per capita tissue consumption *(Fig. 3)* is led by countries with a high standard of living. At the top of the scale are the USA and New Zealand with about 20 kg p.a., and at the other end Africa with about 0.1 kg p.a. Global tissue consumption per person averages 2.9 kg p.a.

Tissue production largely follows consumption statistics. Since the volume to weight ratio of tissue paper is about three to four times higher than other paper grades, long-distance transport is not cost-effective. As a result, less than 5% of total production is traded internationally, as against more than 20% for other grades.

The key to rising tissue consumption is rising standards of living, growing tourism and business travel, and steadily rising hygiene standards.

Above all for institutional and industrial applications the so-called I & I sector-tissue paper is increasingly replacing textiles. There remains the large consumer sector, which includes face-towels, handkerchiefs, toilet paper and other hygienic tissues, to name only the most important products.

Fig. 3: Per capita on tissue consumption in various countries, 1994.



3

Tissue paper: characteristics and production process

Tissue paper basis weight is extremely low at 12 to 25 g/m^2. Most applications therefore require two, three or even four-layer sheets, which are volumetrically softer than single-layer products. Apart from surface layer softness, volumetric softness is very important for user-friendliness. At the same time a multilayer sheet is stronger, and enables systematic control of quality characteristics. This can either be achieved by multilayer formation, or by subsequent lamination.

Multilayer tissue paper has a better volumetric softness (crushability) as against single-layer products. Apart from surface softness ("velvet" feeling), this is important for user-friendliness.

Despite the low basis weight of tissue, modern plants turn out up to 40 tonnes per metre width each day. This demands machine speeds of more than 1500 m/min, sometimes exceeding 2000 m/min. And since tissue machines are much shorter than normal paper or board machines, the web dwell time is likewise extremely short, often less than 2 seconds – and in this time it has to be dewatered e.g. from 0.2% consistency to 95% dry content!

As far as speed is concerned, tissue machines are therefore the "formula 1 racing cars" of paper machinery. This makes machine concept selection very critical, since only a few seconds are available during operation for influencing product quality.

All kinds of tissue machine are in use today, including among the older ones a large number of Fourdrinier and suction breast roll machines.

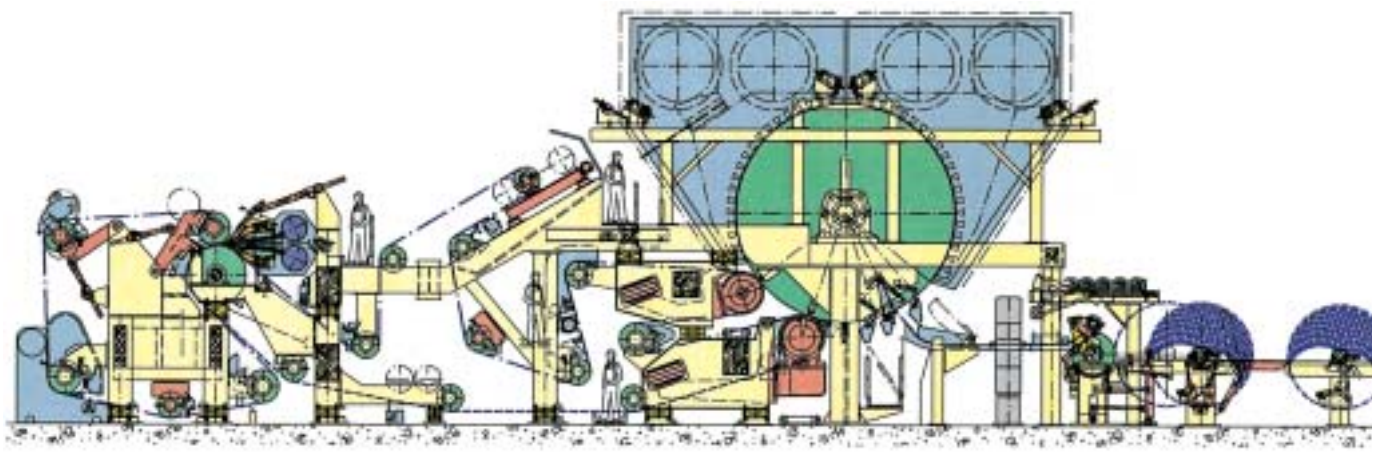
The quality of tissue produced on these machines is good, but their speed and hence output is limited. They were succeeded over the last twenty years by a great many twin-wire machines, which are still among the fastest existing and produce excellent results.

As a further development of twin-wire machines, the CrescentFormer is now state-of-the-art for new installations.

Pulp is introduced into the CrescentFormer from above, directly between the outer wire and the felt. When the wires are separated after the forming roll, the web already lies on the felt, so that no pickup is required here.

After this the web is dewatered mechanically on the Yankee roll in one or two presses to about 40%, and then dried. The highest specific drying performance of about 210 kg/h water per m^2 drying area is only attained by combining the Yankee roll with a high-temperature nozzle hood. The main advantage of the CrescentFormer is extremely high product quality

Fig. 4 and 5: Tissue machine TM 22.



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despite its attractive simplicity. In contrast to the twin-wire former, the CrescentFormer has no inner wire or pickup, which not only makes it much less complex, but also prevents web damage.

Furthermore, sheet forming directly on the relatively soft felt results in higher quality tissue, i.e. more voluminous. And as a welcome „fringe benefit", the CrescentFormer is rather more compact.

The VSPT former family

Demands on new installations vary widely as far as output is concerned. Due to limited transport possibilities, a 50 tonne per day machine is often adequate for regional requirements, while for an entire, densely populated country a 200 t.p.d. plant may barely cover additional needs. The VSPT CrescentFormer range has been tailored to suit these requirements *(Table 1)*.

Not only do these machines differ with regard to capacity, but also as far as equipment is concerned. While state-of-the-art key components are incorporated in all versions, the TM15 and TM10 are comparatively low-cost alternatives covering fringe requirements.

An attractive range of machine types is thus available, all of which meet the peak technology standards to which Voith Sulzer customers are accustomed.

Goals met by our new concepts

VSPT customers expect modern machinery to meet peak quality demands at very high operating efficiencies. On the other hand, operators must be in a position to react flexibly to market needs – market trends hard to forecast at the present time may be decisive for failure or success in the future.

Voith Sulzer and Andritz meet these expectations with future-oriented concepts, whose market popularity is certainly attributable to the innovative components described below:

Highlights of the new overall concept

Multilayer headbox (Fig. 6)

In CrescentFormers the pulp jet from the headbox has to be fixed very rapidly between wire and felt.

Table 1:

Type	Width	Output	Design speed
TM22	2.5 to 6.0 m	75 to 240 t.p.d	2200 rpm
TM15	2.5 to 4.2 m	55 to 140 t.p.d	1500 rpm
TM10	2.0 to 2.7 m	30 to 65 t.p.d	1000 rpm

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Fig. 6: Two-layer headbox.

Fig. 7: Two-layer tissue (different fibres on top and bottom sides).

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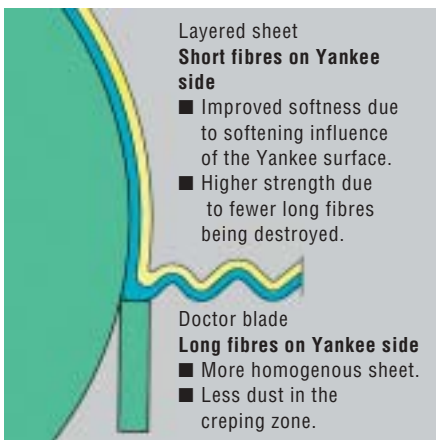

The new headbox design is optimized so that extremely short jet lengths of less then 100 mm can be set. Since the felt is so close to the lower headbox casing, undesirable air intake with the felt into the forming zone is eliminated.

With a 2-layer headbox, different fibre qualities can be incorporated in individual layers. Product quality and manufacturing costs can thus be systematically influenced by the operator *(Fig. 7)*.

If short fibres are used on the Yankee side with a 2-layer headbox, long-fibre destruction during creping is reduced. As a result, the end product is more voluminous and softer on the short-fibre side, and stronger on the long-fibre side.

By subsequent doubling with the two long-fibre sides in the middle, both goals are reached: a soft surface and a strong middle layer.

Fig. 8: Microsections of top and bottom surface layers.

Fig. 9: GapScan.

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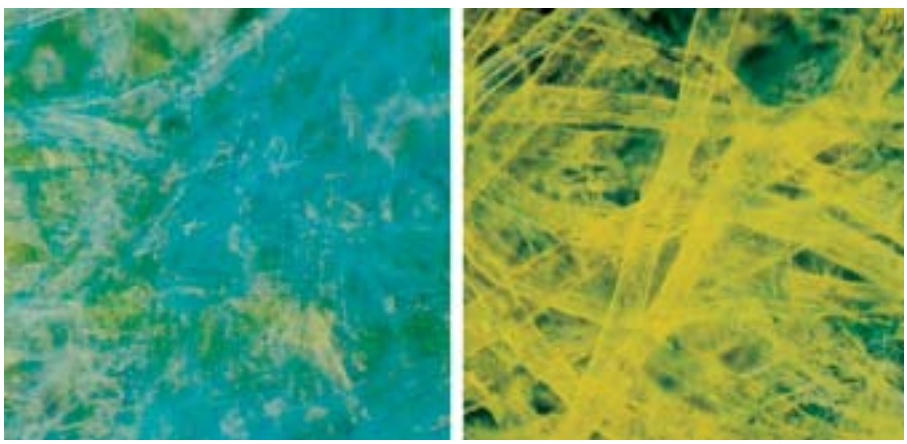

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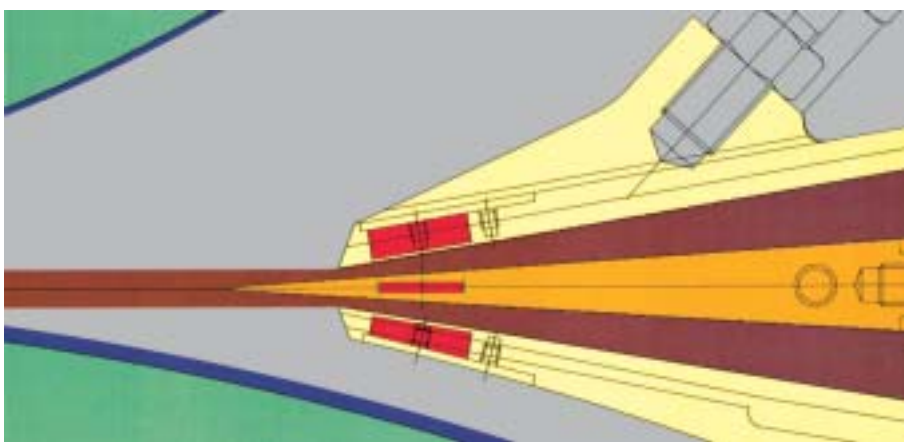

On the other hand, 2-sidedness can be reduced by running long-fibre stock on the Yankee side without subsequent doubling. Since the 2-layer headbox has a fixed central lamella, the two layers can be run at different speeds to improve sheet strength.

Fig. 8 shows layer purity in the 2-layer headbox, the two layers being differently coloured to illustrate fibre density in the Z direction.

Whether in multilayer or single layer headboxes, symmetrical flow in the Z direction – from distributor via turbulence generator to nozzle outlet – is decisive for the outstanding results achieved with VSPT headboxes. Experience has shown that our step diffusor headboxes can operate at higher consistencies than others – under identical conditions.

GapScan (Fig. 9)

This new development in electronic scanning systems – complementing the mechanical system – gives extremely precise nozzle opening data even at widely varying interior pressures. Measuring capsules installed in the upper and lower walls, and also in the intermediate lamella of multilayer headboxes, transmit continuous readings of the exact distance between them. The operator thus has precise data at all times on flow conditions in the headbox.

Suction press-roll with central vacuum (Fig. 10)

As an alternative to the conventional suction roll with vacuum on the operator side, a new patented concept is used with central suction from the drive side. This eliminates the movable ducting with side compensators used on older machines, as well as the vacuum piping on the drive and operator sides. The uncomplicated, straightforward layout is possible thanks to a roller bearing specially developed for tissue machines, combined with a new drive design.

Success through competence

More than ten new installations sold within two years reflect the high market acceptance of our systems and machinery *(Fig. 11)*. These include the four largest machines in Asia, which will be going into service in 1998. The VSPT centres of competence for tissue machinery are Voith Sulzer Brazil, São Paulo, and our

Fig. 10: Suction press roller.

Fig. 11: Recently received orders.

Fig. 12: Tissue technology test facility.

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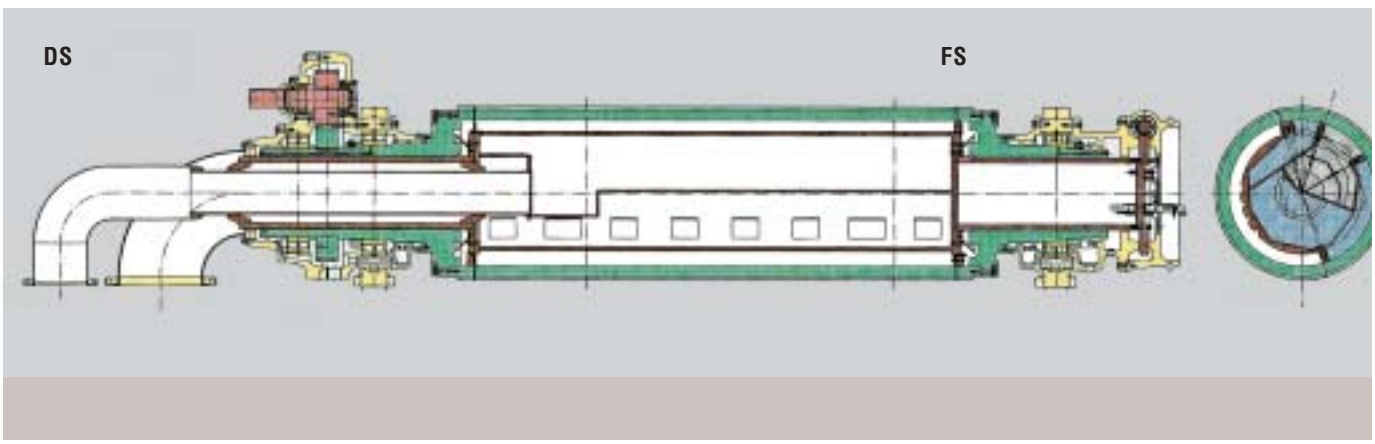


11

Voith Sulzer/Andritz CrescentFormers convince the tissue market world-wide

Tronchetti	Italy	2700 mm	2000 m/min
Tien Long	Taiwan	3650 mm	1800 m/min
Wepa TM 8	Germany	2680 mm	2100 m/min
Thrace TM 3	Greece	2550 mm	1700 m/min
Strepp TM 5	Germany	5600 mm	2200 m/min
Pindo Deli TM 11	Indonesia	5600 mm	2200 m/min
Lontar Papyrus TM 1	Indonesia	5600 mm	2200 m/min
Hengan	China	3650 mm	1650 m/min
Suzhou TM 1	China	5600 mm	2200 m/min
Suzhou TM 2	China	5600 mm	2200 m/min
Goma Camps TM 6	Spain	2860 mm	1800 m/min

Austrian partner Andritz AG, Graz. The São Paulo centre serves customers in North and South America as well as Australia, while our Asian, African and European customers contact Graz for their tissue machinery needs. These two companies jointly operate a tissue technology test facility *(Fig. 12)* in São Paulo – a 1 metre wide high-performance machine with great flexibility for a wide variety of customer trials as well as basic development.

Customer trials are another focal point of our activities. Since many customers cannot afford their own test facilities, they rent machinery from us, for example to carry out trials with their own raw materials for new machinery concepts.

With a wide range of adjustment options, prompt data recording and evaluation, our tissue technology test facility is a valuable tool enabling customers not only to optimize existing plants, but also to design new ones on a reliable basis.

12

QualiFlex Contest – record after record

Voith Sulzer Papiertechnik is the world's only paper machinery supplier to manufacture and market flexible press sleeves for shoe-presses. With a package comprising the NipcoFlex press and QualiFlex press sleeve, Voith Sulzer offers a single-source solution for trouble-free commissioning and cost-effective paper/board production.

Based on a nonwoven yarn reinforcement which is completely embedded in polyurethane, QualiFlex press sleeves are highly reliable and long-lived.

The popular "QualiFlex Contest", an annual event since 1995, offers a prize for the longest QualiFlex sleeve service life. One category is for service life in days, another in terms of nip passes. The winner is awarded a special-edition QualiFlex T-shirt, together with a surprise.

Winner of the first QualiFlex Contest in 1995 was Schoellershammer Industriepapier, Germany, with a QualiFlex sleeve on their machine No. 5 which ran for 308 days. Second prize was awarded to Visy Paper of Sydney, Australia for the QualiFlex sleeve on their machine No. 6 which achieved 53 million nip passes.

In 1996 completely new standards were set: with 70 million nip passes Perlen paper, Switzerland, broke the world record with a blind-drilled QualiFlex press sleeve. In the second category, Stone Europe Carton of Hoya, Germany also broke the record with 516 operating days on the machine No. 2. For 1997 world records are likely to be broken again with QualiFlex press sleeves – what will the winners achieve this time?

QualiFlex B: more void volume for higher dry content

The bigger the sleeve void volume, the better the dry content and production output. Based on this simple formula, blind-drilled QualiFlex B press sleeves have a new drilling pattern as of autumn 1997. The greater number of holes increases the open surface area and thus the void volume. Instead of 440 cm^3/m^2, void volume in future will be 500 cm^3/m^2.

QualiFlex B	Old	New
Hole dia.	2.4 mm	2.2 mm
Hole depth	2.0 mm	2.0 mm
Open surface area	22%	25%
Storage capacity	440 cm^3/m^2	**500 cm^3/m^2**

The author:
Andreas Endters,
QualiFlex press sleeves dept.

Active patent protection – in the interest of our customers

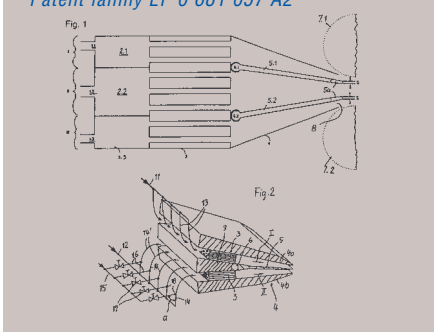
The author:
Helmut Heinzmann,
Paper Machine
Division Graphic,
Patent System

Due to more difficult conditions in the paper industry, such as the rising cost of raw materials, competition has become much tougher. As a result, development activities have to be intensified to meet growing demands on paper quality and productivity – and these strategic developments must be protected by patents.

Among the most important development work of Voith Sulzer Paper Technology recently is in the field of multilayer systems and technology. The aim here is optimal distribution of raw materials in the sheet structure, not only to improve paper characteristics, but also to reduce mill operating and investment costs. Some decisive elements of these developments are illustrated by the following extracts from VSPT patent descriptions and applications.

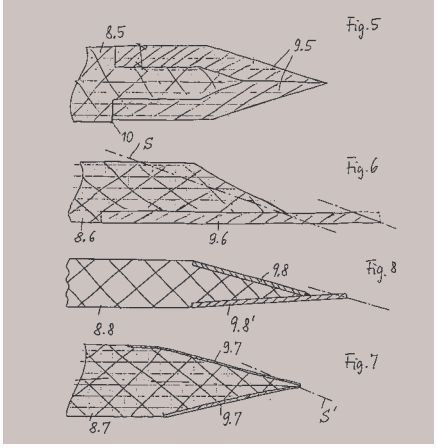
- Decisive for a consistent headbox jet flow is the lamella tip thickness. If this is optimized, product flaws such as striping are prevented and optimal coverage is ensured.

Patent family EP 0 681 057 A2



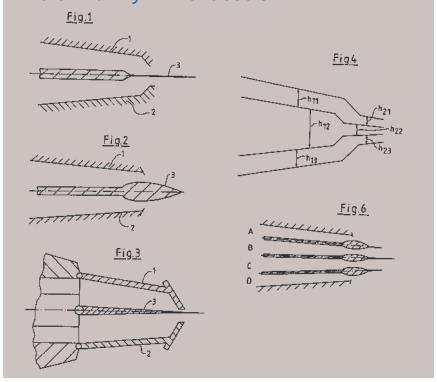
- Decisive for the quality, geometric stability and service life of the lamella tip is its mechanical design.

Patent family EP 0 711 869 A2



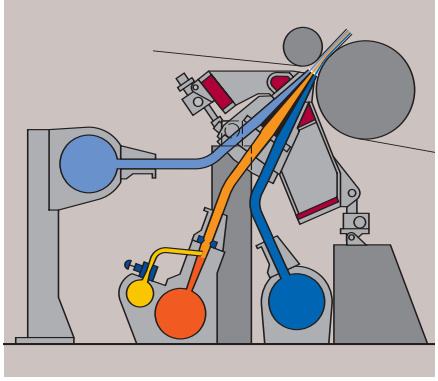
- Decisive for optimal coverage is the flow path in the headbox nozzle. Particularly at high flow velocities, the shape of the nozzle convergence is critical for preventing spraying effects.

Patent family DE 4 323 050 C1



- Decisive for the dimensional stability of paper, linerboard, etc. is systematic adjustment of the basis weight cross profile and fiber orientation cross profile in the individual layers.

Patent family DE 4 321 268 C2



As an innovative partner to the paper industry, Voith Sulzer Paper Technology invests in new technologies to the benefit of our customers. All these innovations and developments are comprehensively protected by taking out patents accordingly.

Internal topics

Paper Machine Division Board and Packaging under new management

Dipl.-Ing. Wolf-Dieter Baumann, the previous manager of the Paper Machine Division Board and Packaging, will leave Voith Sulzer Papiertechnik GmbH & Co. KG with effect from February 28, 1998 to join the Körber AG mechanical engineering group in Hamburg, which is active throughout the world in tobacco processing, paper processing and production engineering. Mr. Baumann will start his new career as deputy management spokesman for PapTis Holding GmbH and will become chairman of the board of management in mid 1999 at the latest. It is also intended that Mr. Baumann should later join Körber AG Group Board of Management.

Mr. Baumann came to J.M. Voith GmbH, Heidenheim, Germany, in 1981. From 1985 on he worked for Voith Inc. in the USA, and in 1988 took over the newly established Voith office in Moscow. In 1992 he was appointed executive sales manager by the Board of Management of J. M. Voith AG, St. Pölten, Austria, and later became head of the Paper Engineering product division. In the course of the divisional restructuring of Voith Sulzer Papiertechnik, Mr. Baumann accomplished valuable organizational work in connection with the establishment of the Board and Packaging Paper Machinery Competence Center. Mr. Baumann's move to Körber AG will have no influence on the relationship between the Voith and Körber groups.

Otto L. Heissenberger, born in 1952, has been appointed Mr. Baumann's successor. Until recently he was Senior Vice President of Voith Sulzer Papiertechnik's Middletown plant in the USA. Mr. Heissenberger started his career as engineer when he joined the Andritz AG mechanical engineering company in Graz, Austria, in 1977.

While employed by several of the Sulzer Escher Wyss Group's companies, his activities in the fields of technology, sales and management took him to Germany, England and finally to the USA. Otto L. Heissenberger is an experienced expert in the board and packing material machinery area: He will assume worldwide responsibility for the Competence Center and the markets for this particular product area. As of January 1, 1998, Mr. Heissenberger has been appointed a member of the Board of Management of J.M. Voith AG, St. Pölten, Austria, and Managing Director of Voith Sulzer Papiertechnik GmbH & Co. KG in Heidenheim, Germany.

Management of Voith Sulzer Papiermaschinen GmbH, Heidenheim, enlarged

As of September 1, 1997, Harry J. Hackl became head of the new Sales business area at Voith Sulzer Papiermaschinen GmbH, Heidenheim, Germany.

Harry J. Hackl has many years of widespread experience in international plant construction. For more than 20 years he headed the cellulose plant business area at Krauss Maffei in Munich and the companies which took over these activities from Krauss Maffei. During this time he cooperated successfully with Voith and Sulzer Escher Wyss on complete, integrated pulp and paper plant projects worldwide.

In his capacity as a member of the board of management of Voith Sulzer Papiermaschinen GmbH, Heidenheim, he will be in charge of sales of graphic papermaking machinery and complete plants.

New Office in Finland

"You should have made this move earlier! But it's great that you're here at last. Competition is what we need here in Finland. Alternative technologies and prices. We're not interested in discussing our strategies with some agent or other, but directly with yourselves!"

This is how our Finnish customers reacted when Voith Sulzer Papiertechnik opened its own office in Vantaa, Helsinki, on October 1, 1997.

By expressing their needs and requirements in this way our customers have also determined our new office's strategy: Improved, more rapid service in closer proximity to the customer, acting as a competent discussion partner, providing the right people for round-table meetings, networking projects within our product areas, intensive observation of the market – and of course, the most important target, increasing our market share in this country.

Since Finland joined the Common Market it has opened its economy and become increasingly attractive for foreign firms.

In the past few years many new papermaking machines have been installed. A temporary decline in investments is therefore expected in the near future. But much reconstruction work on a larger or smaller scale is required to update older machines and improve efficiency and quality. We are confident that with our successful system components, this area will offer us some worthwhile opportunities.

Jörg Fischer, previously an executive at J. M. Voith AG in St. Pölten, Austria, is in charge of the new office. Manfred Kohrs, a material technology expert from Ravensburg, Germany, Kenneth Krook of the previous agents Telko, Jouko Jokinen, who has moved from Appleton Mills to Voith and Minna Siitonen as assistant complete the team.

Although Finland has a reputation as one of the leading paper production countries, the following facts may surprise the reader:

A total of 140 papermaking machines scattered among 50 firms generate an annual domestic output of 10.4 million tons of paper and board. Taking Finnish companies' production abroad into consideration, annual production exceeds 20 million tons.

In Finland the level of surface treatment is very high. Nowhere else is the ratio between paper coating machines and the country's size is so high. The quality of the domestic raw material, the above-average level of education and the expertise of Finnish paper makers are the keys to this unique range of paper types.

With these resources, the Finnish paper industry should face a secure future.

With UPM-Kymmene, Enso, Metsä Seria, Myllykoski and Jaako Pöyry we have our highest density of so-called key customers in Finland. Although these companies are organized according to a largely decentralized competence structure, some major research institutions and strategy units are located in Finland and influence decisions worldwide.

The new office of Voith Sulzer Papiertechnik is located between Helsinki airport and the city center.

The address is
FIN-01620 Vantaa, Jaakonkatu 2,
Telephone +0358-9-276615-0,
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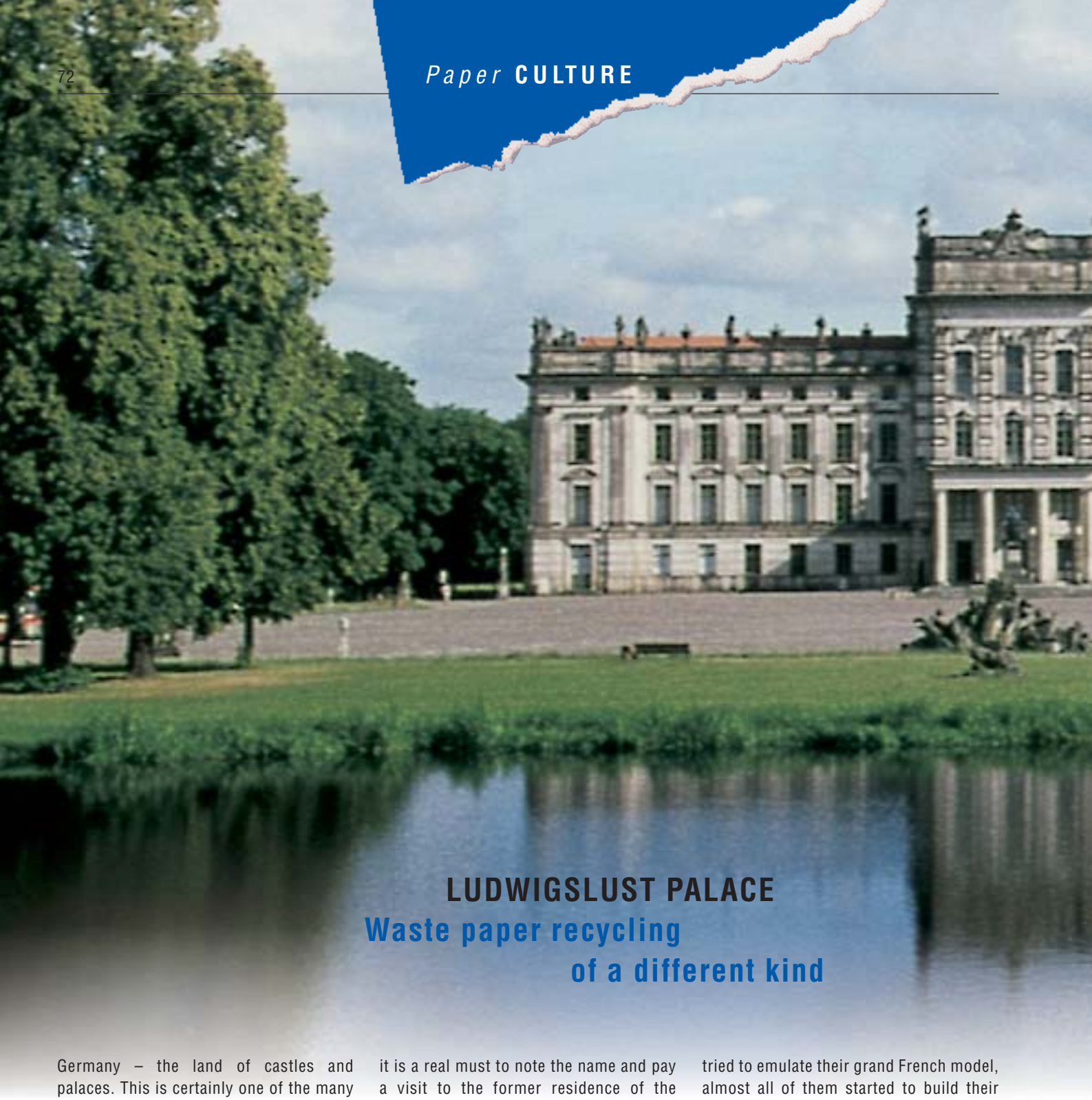


LUDWIGSLUST PALACE

Waste paper recycling of a different kind

Germany – the land of castles and palaces. This is certainly one of the many impressions that the foreign visitor – whether on vacation or on a business trip – absorbs and takes home from the kaleidoscopic picture of Good Old Germany. Heidelberg and Neuschwanstein are well-known in Philadelphia and in Tokyo. In the meantime Sanssouci has also re-entered the list of castles and palaces worth seeing. But when talking about the more significant palaces in Germany's new Federal States – who has ever heard of Ludwigslust Palace? For paper manufacturers it is a real must to note the name and pay a visit to the former residence of the Dukes of Mecklenburg. The late Baroque edifice is located about 80 kilometers east of Hamburg. Surrounded by gardens which are really worth seeing it harbors a peculiarity which has nowhere else survived the course of time both in dimension and quality: a magnificent interior made of waste paper – or, to be more precise, of papier-mâché.

In the 18th century, when the numerous rulers of the German Particularist states tried to emulate their grand French model, almost all of them started to build their personal Versailles palaces. Some of them inevitably ran out of money before they could pay for valuable marble, fine timber and costly and complex stone-dressing and plastering work. Duke Frederick of Mecklenburg (1717-1785) was also stricken with a shortage of money. His father Christian II Ludwig (1663-1756), who had a great passion for hunting, had started to enlarge his hunting lodge near the village of Klenow, an area abounding in forests and game. In 1754

Fine statues, a classic decorative interior – the astonishingly genuine-looking export bestsellers made by the thrifty Duke of Mecklenburg reveal their ingenious substance only at second glance: papier-mâché made of recycled files from the State sovereign's administration and finance chancellery.

he ordered that "…from now on and in the future the said location should be named Ludwigs-Lust". His son Frederick appreciated Ludwigslust likewise, though in his case a passion for hunting played only a minor role.

The tranquillity and remoteness of the site suited his own modest character and piety, an economical household, a marked interest in the natural sciences and his affection for etchings "from nature". Frederick had studied the exemplary economy of the Netherlands and became acquaint-

ed with French architecture and landscaping. Ludwigslust was the perfect place to combine his personal interests with model agricultural projects aimed at improving the rural structure. He resolved to relocate his residence from the city of Schwerin to Ludwigslust and had the hunting lodge replaced by a completely new palace that complied with his representative and social duties as State sovereign. Although the style of King Louis XIV served Frederick as a model, the funds available from the Duke's "Sand and Wood Purse" – the proceeds from selling construction sand and felled wood being his sole significant source of income – were far from matching the budget of the Sun King.

The Golden Hall of Ludwigslust Palace with its sumptuous interior, its immense columns, vases, wall decorations and the acanthus leaves on the ceiling, all in the graceful splendor of late Rococo style. All gold-plated ornaments are made of Ludwigslust Board, a papier-mâché formula that has not been completely deciphered until today.

How or by whom Frederick was inspired to use recycled waste paper instead of the customary expensive materials for his new palace's interior work has not been handed down. At that time papier-mâché was already used as material for small items such as devotional pictures, dolls or tobacco boxes. But to conjure up columns several meters in diameter and the splendid interior architecture of a Baroque palace from this material was an extraordinary venture even in this architectural epoch of "aesthetic illusion". If his plans had not been realized with the kind of perfection that is still admired today, the Duke would have become the laughing stock of most European Courts. The fact that he succeeded in marketing this idea profitably verges on genius. After successfully demonstrating its manufacturing formulae, which even today have not been completely brought to light, the "Ludwigslust Board Manufactory" supplied numerous noble houses between Vienna and Paris which – also suffering from the building urge – had been in the same dire financial straits as Duke Frederick himself.

But his plans had to be postponed for the moment. With the Seven Years' War Frederick the Great, Duke Frederick's famous

The Ducal gallery in the Ludwigslust court church. Its artistic decoration and drapery is resistant to woodworm and moths: everything is made of papier-mâché. (Picture below).

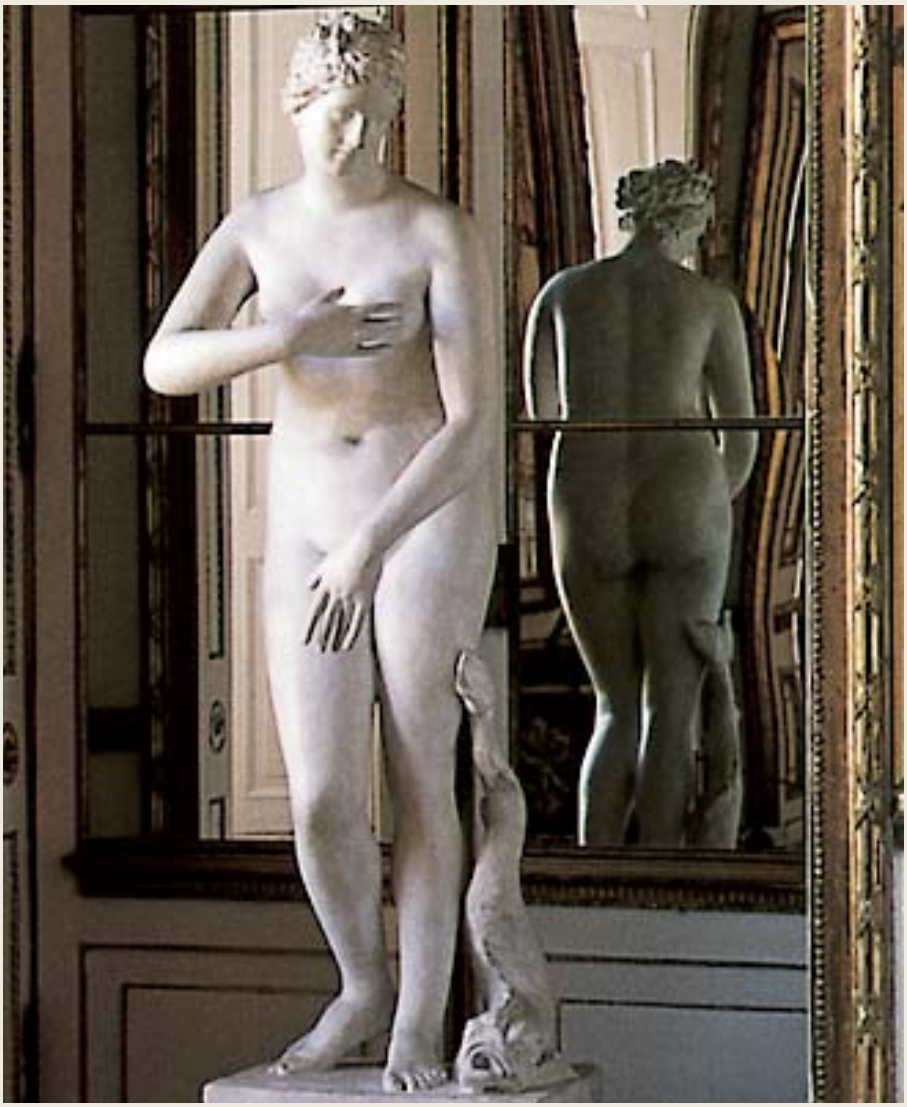
namesake in the adjacent State of Brandenburg, not only put military pressure on Maria Theresa and Austria. Prussia's associated dynasties were unrelentingly asked for "support", that is to say a contribution to the war chest.

As a consequence, work on Ludwigslust did start not until 1764. The Court Church was the first structure to be built, between 1765 and 1770, and tested the idea of rich decoration made of papier-mâché on a small scale. Gold-plated ornaments and textile drapery with elaborate folds decorate the balustrade. But every single item is made from waste paper! The six splendid candleholders including their 50 cm high altar candles are of the same origin. Ducal cost-awareness considered even the use of beeswax as too much of a luxury. A clever spring mechanism inserts inexpensive tallow candles of any desired size into the papier-mâché sleeves and pushes them upwards so that only their flickering wicks are visible.

The masterpiece of Ludwigslust waste paper recycling is in the true sense of the word the so-called "Golden Hall" in the central tract of the new palace which was finally completed in 1776. Although time has left its mark – in particular the temporary misuse after the Second World War when the Red Army used Ludwigslust as its local headquarters – the multiple-storey banqueting hall still reflects the spatial concepts of its owner in its architecture: elegant splendor, symmetrical Louis-Seize style, combined with the playful forms of the late Rococo period. Monumental columns, gold-plated ornaments, brackets, cornices, vases, busts, door and mirror frames and decorative chandeliers are all made from papier-mâché with the help of pre-cast plaster moulds, pressed or – in the case of the more complex rarities – modeled and painted fastidiously by hand.

During the reign of Duke Frederick the "Golden Hall" was primarily reserved for concerts of church music performed by the Ludwigslust Court Orchestra, one of the most significant interpreters of its time. Contrary to any assumption based on its impressive splendor, the "Golden Hall" has never served as a venue for sumptuous evening balls. Guests were refused admission to the gallery. This was not to prevent them from having a closer look at the papier-mâché ceiling ornaments: the Duke's pious attitude did not tolerate gay festivities and in no circumstances a view from the top into the – at that time quite opulent – décolletés of the ladies.

An English travel book of 1781 is considered the earliest documentation on Ludwigslust papier-mâché. It was the first book to mention the twelve Imperial Roman Statues, "made of pure board", which adorned the park during the summer. In the 1940s the figures became victims of the ravages of war, but by then "Ludwigslust Board" had weathered wind and storms for almost two centuries. Numerous attempts to discover the secret of the manufacturing principle and durability of Ludwigslust Board, whether by workshop espionage or by luring away the craftsmen, all failed. Duke Frederick entrusted the task of expanding the manufactory to his loyal lackey John Frederick Bachmann, who kept the secret of the exact ingredients until he died in 1815. Some records and receipts tell of the acquisition of large quantities of ethyl



Two examples from the Ludwigslust Board Manufactory's numerous bestsellers: La Frileuse after Antoine Houdon (left) and the Venus de Medici after the original now in the Uffizi in Florence. Both pieces were made around 1790. Even today, after two centuries, these accurate replicas in their deceptive terracotta or marble never fail to impress their admirers.

alcohol, flour and bone glue. Waste paper – in particular old files and paper from the chancelleries of the Ducal Finance and State Administration – always constituted the basic material from which Ludwigslust Board was produced. However, in the heyday of the manufactory this source of material no longer sufficed. By the end of 18th century Ludwigslust was probably the largest waste paper recycling center in Central Europe. This assumption is backed by the fact that the layers of glued waste paper found in the interior of some of the busts prove to have been written on in several different languages.

In the beginning the Ludwigslust manufactory concentrated on architectural needs, ornamental elements and rosettes for ceilings and frames and moldings for walls, mirrors and doors. Later vases, chandeliers and furniture were added to the product range. To round things off, renowned artists created replicas of world-famous statues, which were then modeled in complex processes from numerous layers of wet and glued waste paper. Fine finish, polishing and colored frames resulted in an astonishingly genuine marble or terracotta look. The "Venus de Medici" and a bust of Martin Luther were among the export bestsellers of the Ludwigslust manufactory.

It's worth saying again – Ludwigslust and the chance of admiring the papier-mâché creativity of bygone days are really worth a visit, despite the fact that not all the rare pieces born of the ducal thrift have survived until today. It is a pity that nothing has remained of the manufactory itself. The visitor must make do with the results that can be admired in the Court Church and the Palace. Some of them have been restored with loving care, while many other pieces still await proficient restoration.

Be that as it may: the paper enthusiast or the paper maker will become aware of how many diverse possibilities his working material contains, a material which today is considered common property and is always available. And if waste paper's perspectives really change in the era of electronic media, someone might come up with a new (old?) notion à la Duke Frederick. There is always a future for brave and bright ideas.

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