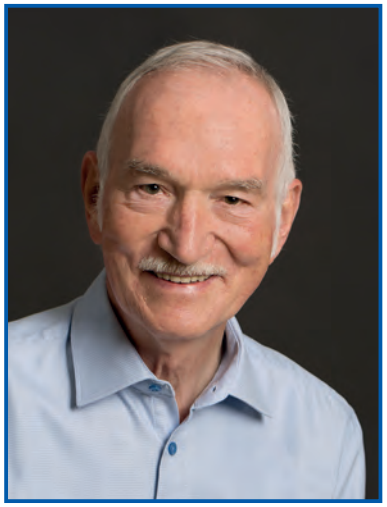
THE PRESS

Consultancy on Hydro-Dyn Press Systems

No. 5/2024

Hello from the Editor



Dr.-Ing. Ulrich Haupt

Dear Hydro-Dyn press user,
dear colleague interested in the Hydro-Dyn technology,

You are holding a new and current issue of "THE PRESS" in your hands.

This Newsletter illustrates again the experience gathered by press users with this version of DB-press system. In addition, you will find a description of the variety of technical modifications improving considerably the efficiency of this machine. For almost ten years, modern versions of Al-plates with modified Teflon pads have proven very successful in operation. You are invited to have a look at the improvements explained in this Newsletter.

When operating a production line with integrated Hydro-Dyn press, priorities for economic production are

- stability of press operation (avoiding line stops),
- low operating costs of the press,
- satisfactory product quality provided by a uniform pressure profile and acceptable product edges.

Observations on many presses, analysis of local machine wear and experiments on several test rigs revealed an important irregularity of the oil flow in the machine.

This irregularity was corrected by modifying the flow path of the oil from the heating platen to the oil film near the product.

Some press users were convinced of the success of this new technology and decided to change their press to the new version, just modifying the Al-plates with modern Teflon pads.

The result of this measure was highly successful and led to an improvement in operational stability of the press, in lower operational costs of the machine and in improved product quality.

The background and the technical solution are illustrated in the next "What's new on Hydro-Dyn" chapter of this Newsletter.

In the past, many Hydro-Dyn press users were faced with quality problems on the product edges. On the basis of measurements in a production press, a weak point in the Teflon edge oil groove design could be discovered. A simple modification of the groove system in the two outer Teflon pads was the answer to solve this problem – as explained in the following chapter of this issue.

What else can be found in this Newsletter?

2 press users are reporting about the operation of their machines

- Homogeneous Vinyl flooring production of Forbo Novilon / Netherland
- Production of steel / rubber composites for noise reduction in automobile cars in the Company Trelleborg Sealing Solutions Kalmar / Sweden operating 2 Hydro-Dyn presses

In addition, an article of the German spare parts producer for Hydro-Dyn presses FMH invites you to have a look at the wide range of spare parts available for the machine.

The last page of this Newsletter is traditionally reserved for so-called "Hydro-Dyn pioneers". This time it is dedicated to Volker Forberich, the creative design engineer of Hydro-Dyn heating platen, Al-plates and Teflon pads.

CONTENTS

What's new on Hydro-Dyn?

Why "New Developments" on Hydro-Dyn press?

Your Hydro-Dyn press is running smoothly? – So why should you worry about "New developments".

Here is the answer:

An investment at moderate costs will give you significant operational cost benefits and improved product quality. In addition, your press will operate more stably and reliably and is prepared for the future.

Figure 1. *Former Al-nozzle and standard O-ring in a Hydro-Dyn press*

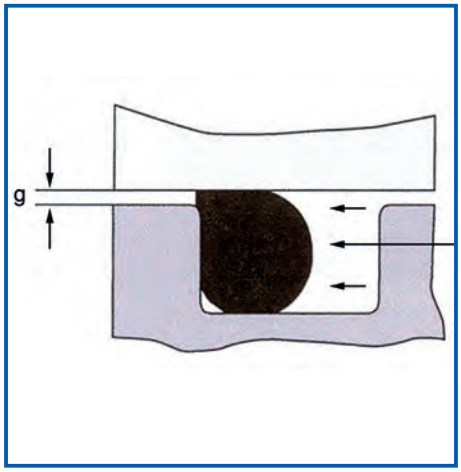


Figure 2. *Sealing effect of the O-ring when high pressure in the center pushes the ring outwards*

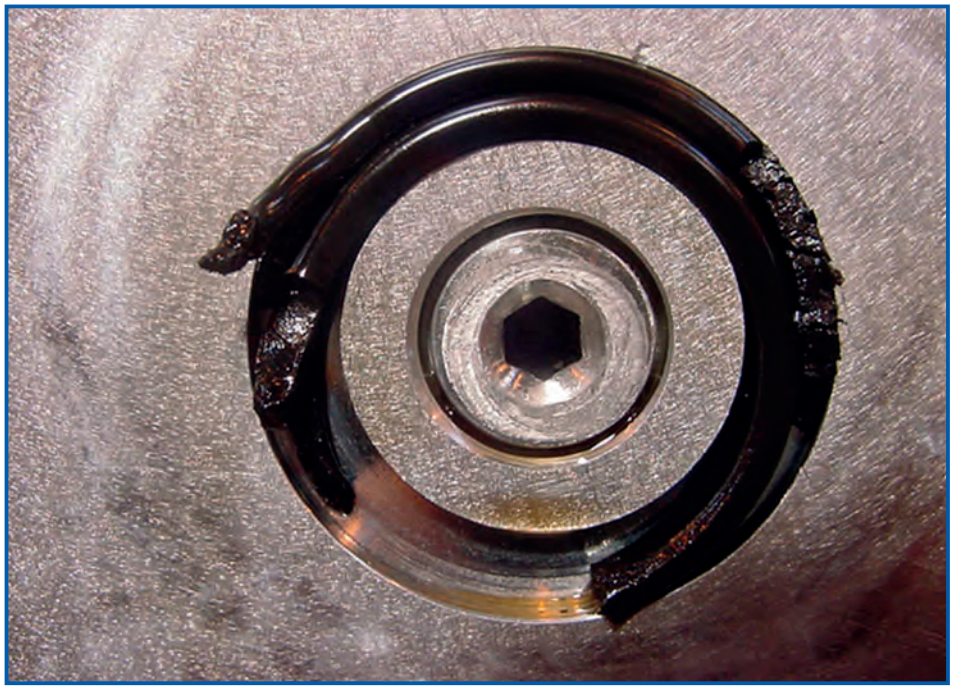


Figure 3. *2 O-rings in a single groove – a surprising constellation found in many Hydro-Dyn presses*

Here are the details:

NEW

A completely new generation of Al-plates with Teflon for Hydro-Dyn presses

For nearly 50 years, Hydro-Dyn presses have been built with a kind of standard Al-plates concept with Teflon pads used as key element for the steel belt to glide on the Teflon surface. Only minor corrections were made during this long period.

Companies using the press are quite familiar with the view of the reverse side of the Al-plates (see figure 1) with the Al-nozzle, the wide O-ring groove and the O-ring seal on the outer side of the groove.

The function of the O-ring was based on the assumption that the oil jet from the heating platen to the steel belt is under high pressure. The O-ring would then seal this pressure against the low level of atmospheric pressure outside of the O-ring, as illustrated in figure 2.

Years ago – as a surprise – press users reported about the discovery of two O-rings in one groove as shown in Fig. 3, later found in other presses as well.

The precondition for this scenario: the O-ring can only move if the gap between heating platen and Al-plate is wide enough (5 mm). The second prerequisite is possibly even more important: There must be a suction force inside the O-ring sucking the second O-ring so that it travels into the groove.

Investigations on several test rigs were accomplished, which in fact confirmed this suction effect inside the O-ring. A practical application of this phenomenon was found by a suction pump, which is used by the fire brigade to pump out flooded cellars.

A water jet on the left side in figure 4 produces a suction effect removing water from below to the exit of the pump on the right side.

Systematic tests were done using a fluid flow that passes a 1.2 mm heating platen nozzle and continues through Al-nozzles of various diameters. Results of these tests are documented in figure 5 showing a deep vacuum for an Al-nozzle of a diameter of

3 mm and a decreasing vacuum for larger nozzle diameters.

The current Al-nozzle in Hydro-Dyn presses has a diameter of 6 mm.

Figure 6 shows the new flow configuration that differs from the former assumption.

Figure 7 illustrates the flow around an Al-plate with Teflon in Hydro-Dyn presses. The fluid in the oil film disappears in the gaps between the pads, travels down to the heating platen and then mixes with the in-feed and with the return flow. The motor for this scenario is the suction effect inside the O-ring. The described non-uniform leak flow represents an energy loss (lower in-feed temperature) and lower oil uniformity of the fluid distribution over the press surface. The flow configuration as shown in figure 7 is confirmed by many observations on press components.

As illustrated in figure 8 (next page), the suction pressure level inside the O-ring was reduced by changing the Al-nozzle diameter from 6 to 9 mm. In addition, the O-ring position was changed from outside of the O-ring groove to the inside.

Figure 9 (next page) shows the reverse side of an Al-plate of new design.

The new press pad version was installed in some Hydro-Dyn production presses with great success. The result was a reduced leak flow under the Al-plates, an increased oil film thickness and a more uniform oil distribution over the press surface.

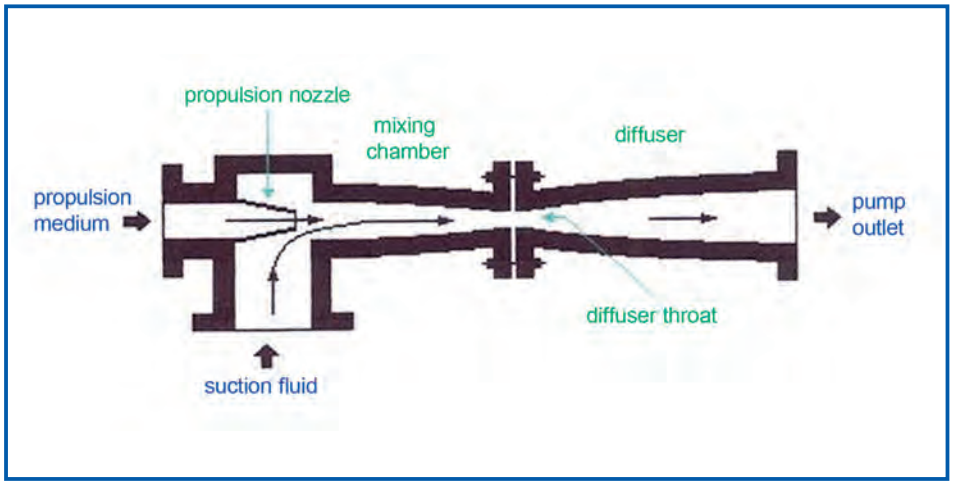


Figure 4. *Functional principle of a water jet pump to suck water – as practically used in many applications*

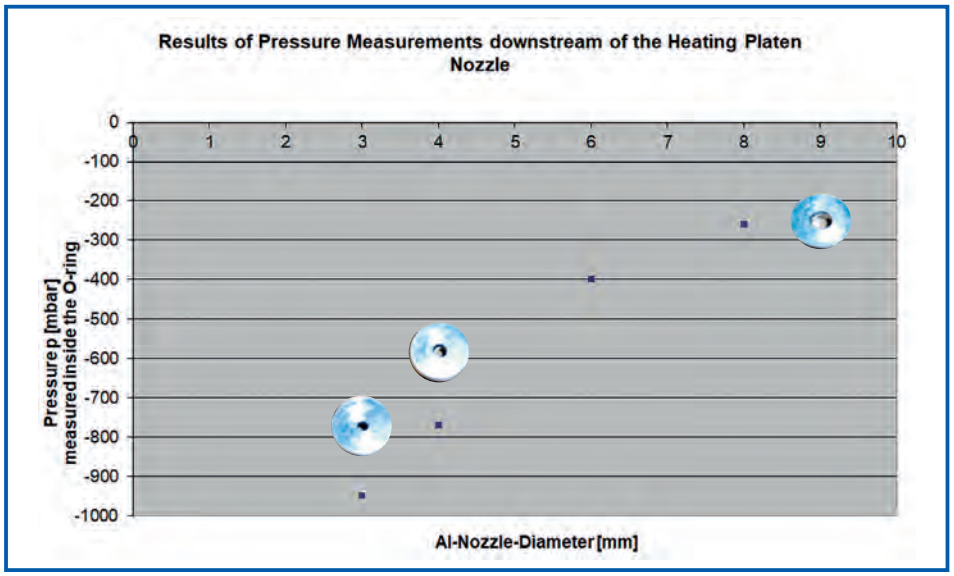


Figure 5. *Test results with oil jet passing through an Al-nozzle of different diameter demonstrating the generation of an increasing suction pressure with decreasing nozzle diameters*

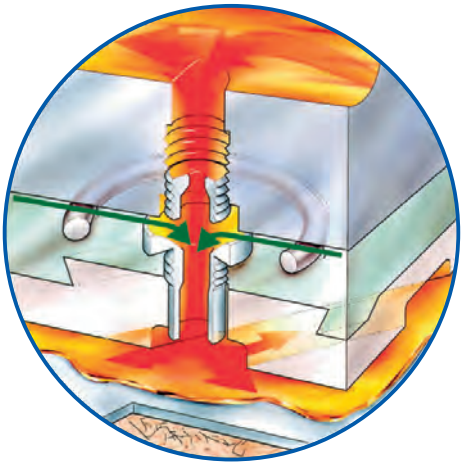


Figure 6. *New understanding of the flow path around the Al-nozzle in a Hydro-Dyn press*

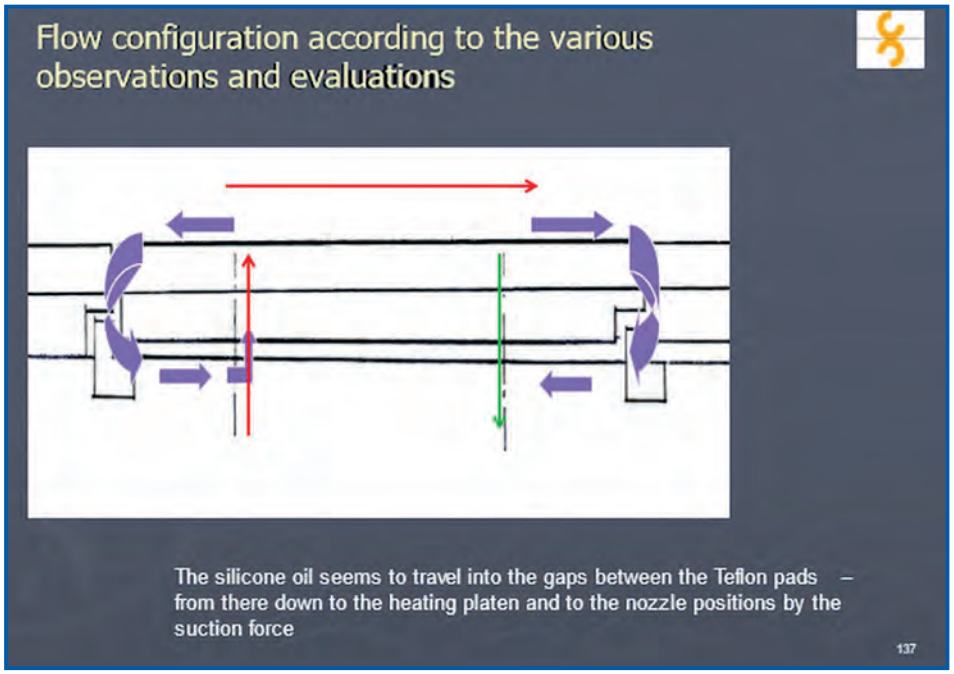


Figure 7. *Cross-sectional view of an Al-plate with Teflon pad in a Hydro-Dyn press with in-feed (red arrow) and return flow (green arrow) as well as the leak flow between and under the plates*

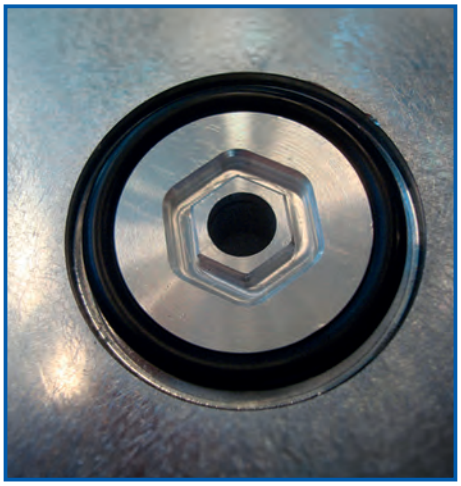


Figure 8. New Al-plate design successfully used in a number of Hydro-Dyn production presses today

A new scraper pad for Hydro-Dyn presses

NEW

Stable operation of a DB-press without steel belt tracking issues is obtained by keeping the press drums almost oil-free. Several special oil scraping pad versions in the press out-feed have been developed in the past, which generally improved the scraping effect.

A new scraper pad as illustrated in figure 10 was recently designed by eliminating certain weak points of the former version. The scraped oil is dragged to both sides of the machine into the oil troughs, this solution turned out to be very efficient even in press cooling zones with higher oil viscosity.

How to achieve good product edges in Hydro-Dyn presses

NEW

In Hydro-Dyn presses, there is no seal between high pressure in the product area and atmospheric pressure outside of the product. This design is extremely flexible when working with various product widths.

However, there is an oil flow between Teflon surface and steel belt undergoing a pressure drop towards the sides, which may affect the product edge.

A number of measures were developed in the past to achieve to satisfactory product edges.

Recently, an important weak point in the design of the oil grooves in the Teflon has been discovered that is limited to the edge zones of the press surface.

The inclined oil grooves near the product edges transmit low pressure towards the

center leading to reduced pressure in the whole product edge zone. In addition, pressure measurements in this area showed a periodic characteristic – but not a uniform load on the product.

The angle of the oil grooves in the Teflon pads against the working direction turned out to be efficient in the press center by avoiding lines on the pressed material. But this angle is unfavorable in the edge zones.

A new design was developed creating a system with a smaller oil groove angle in the edge zones only (see figure 11). With this design, only two outer Teflon edge pads can be replaced without any changes to the nozzle configuration.

A production press provided with this modification proved the success of the new design by improving the product edge quality.

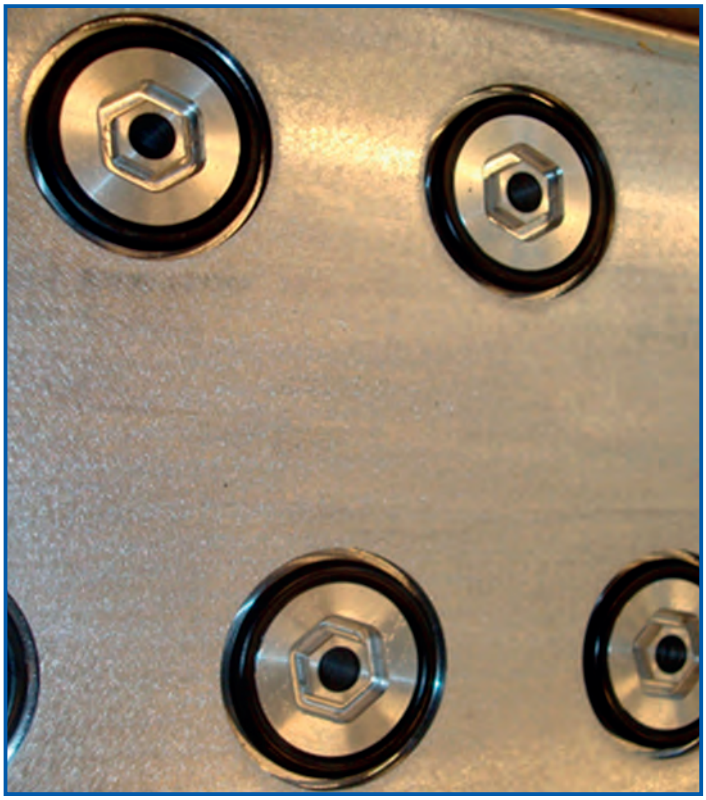


Figure 9. New Teflon surface design after years of operation in the press

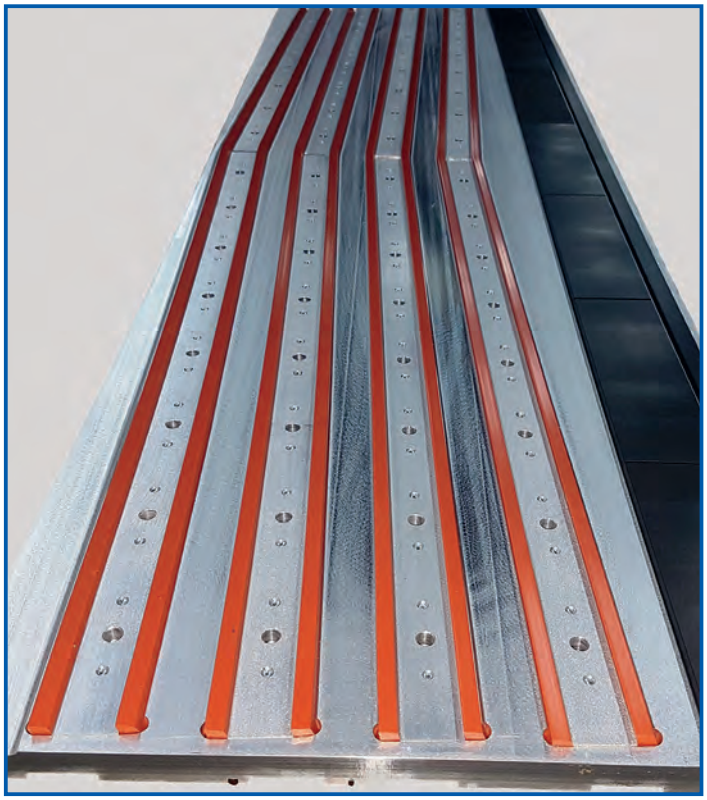


Figure 10. New scraper pad design with even higher efficiency than the former versions

Figure 11. New design Teflon edge pads improving the product edge quality

Director of BISON MDF, Vietnam Mr. Hoi Dong and Dr. U. Haupt during an inspection of the Hydro-Dyn press for MDF production

Forbo's homogeneous Vinyl flooring production with a Hydro-Dyn press

Project manager Gerrit Nijdam

Thanks to the combination of heating and cooling under pressure in a single machine, Hydro-Dyn double belt presses with an isobaric characteristic are perfectly suitable for the production of vinyl flooring. This has proven to be successful on two production presses.

Other technologies are characterized by spreading vinyl granules on a transport belt, heating of this material followed by a final cooling process. The material data and product qualities can be increased significantly by applying pressure during the abovementioned production process.

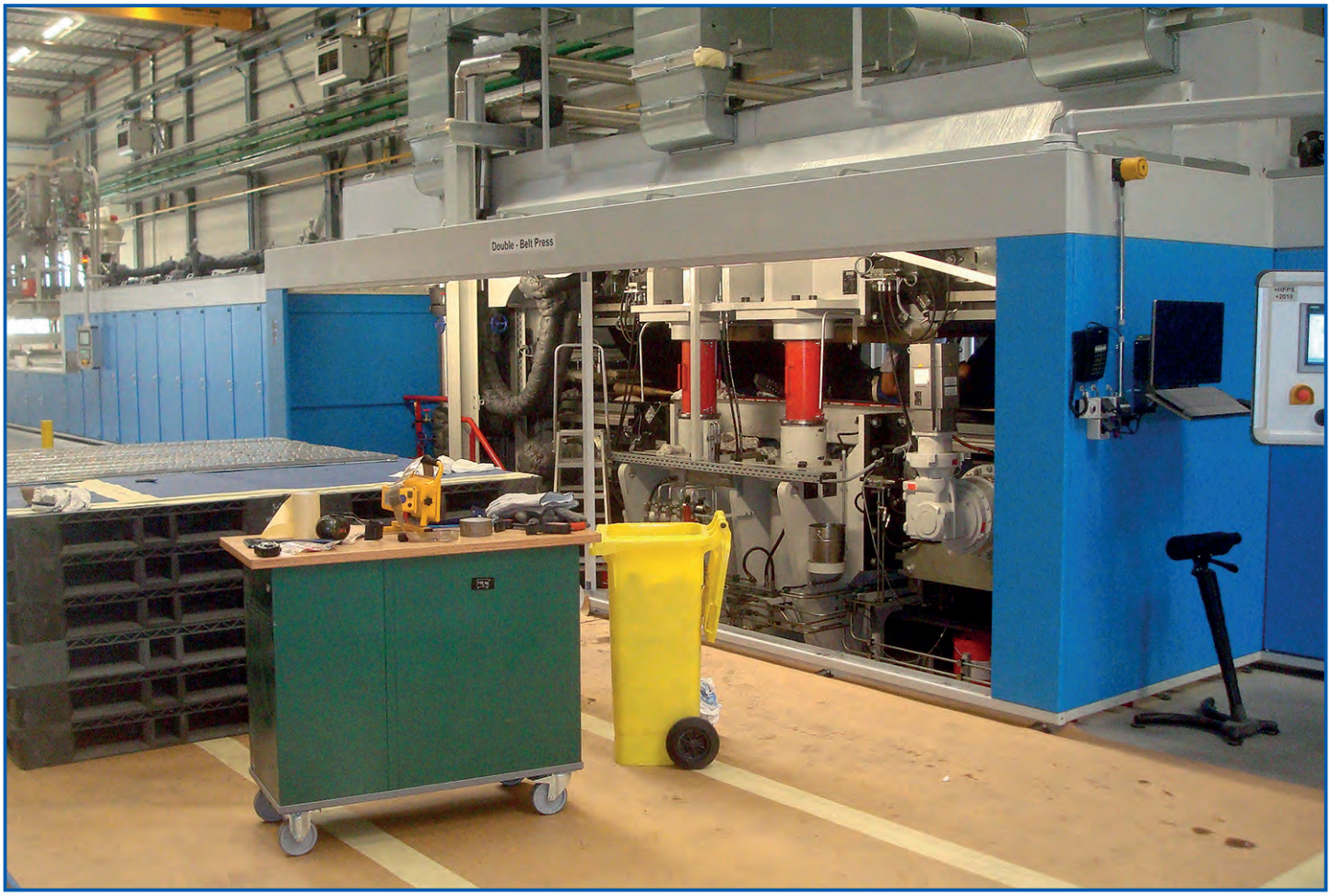
Forbo, a well-known producer of Vinyl flooring in the Netherlands, was planning a new continuous production line for homogeneous Vinyl flooring. As a combination of both technologies above, the following order of the line components was chosen:

Spreading granules on a transport belt, heating of the material without pressure,

applying pressure on the heated material by a Hydro-Dyn press and finally passing through a cooling zone without pressure. The product is then finalized by several treatments before it is wound up to coils.

View of the Hydro-Dyn press from the operator side

The thickness distribution accuracy over the width of the flooring material is satis-



Forbo's production line for homogeneous vinyl flooring with the Hydro-Dyn press

Scattered Vinyl granules on their passage to the heating zone, the press and the cooling zone

factorily high, so that the line works without a sanding process.

The Hydro-Dyn press was supplied by Sandvik and erected in Forbo's plant in Coevorden. Dr. Haupt was invited to work on this press towards an improvement of the product quality and the performance of this machine.

A number of modifications of press components were implemented by the consulting press specialist. The use of the newly developed Teflon pad system with increased Al-nozzle diameter was one of the important measures to achieve a stable machine operation with satisfactory product quality and line speed.

Forbo would like to thank Dr. Haupt for his successful work on the press and his continuous technical support for the machine and the press operators.

Pump room behind the press

Wound product at the rear end of the production line

Two Hydro-Dyn presses operating in Trelleborg's technical laminate production in Kalmar / Sweden

Plant manager Ulf Johansson

Trelleborg's production line 5

Trelleborg Sealing Solutions Kalmar AB is the world's leading manufacturer of noise suppression and anti-vibration elements mainly for automotive, but also for other industrial applications.

Such elements consist of two or multiple very thin steel and rubber layers, as illustrated in the following two sketches of brake shims for cars.

Manufacturing of such material in Kalmar / Sweden is performed on two Hydro-Dyn presses suitable for up to 70 bar specific pressure in an isobaric press process.

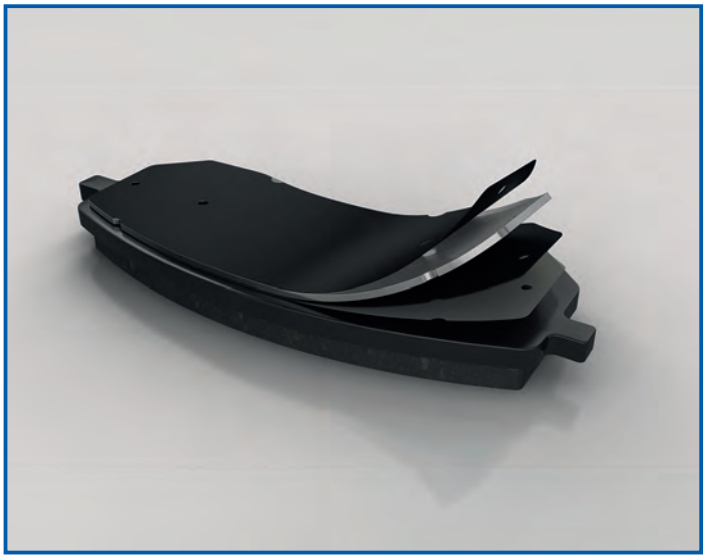
In a following process step, particular elements are then stamped out of the material leaving the press.

These elements are designed for their use as anti-vibration components in cars and in many other industrial applications, where vibrating parts have to be dampened. Avoiding noise from car brakes is a key application of Trelleborg's production.

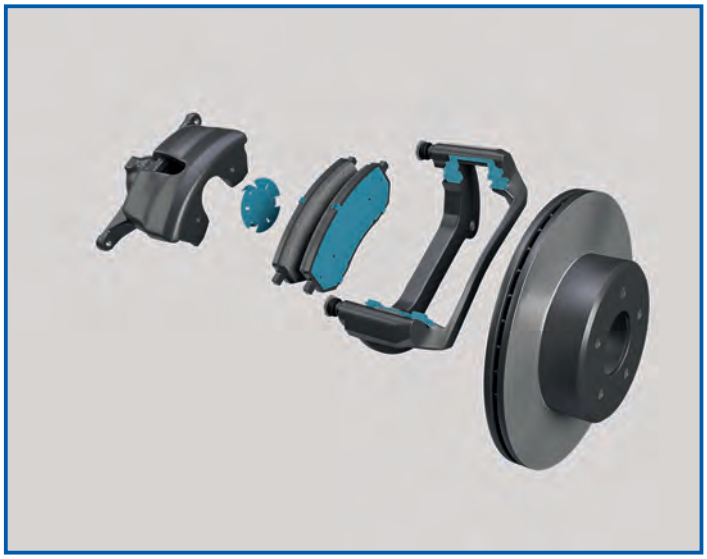
Trelleborg started its continuous production on a first Hydro-Dyn press in 2002 and extended its production on a second line with another Hydro-Dyn press in 2009.

Dr. Haupt accompanied the erection of the presses and provided technical assistance during the time of production.

In 2014, Trelleborg decided to change the Teflon pad system in one of the Hydro-



Anti-noise shims on car brakes consisting of multiple layers of steel and rubber



Exploded view of brake in a car showing the position of the brake shim

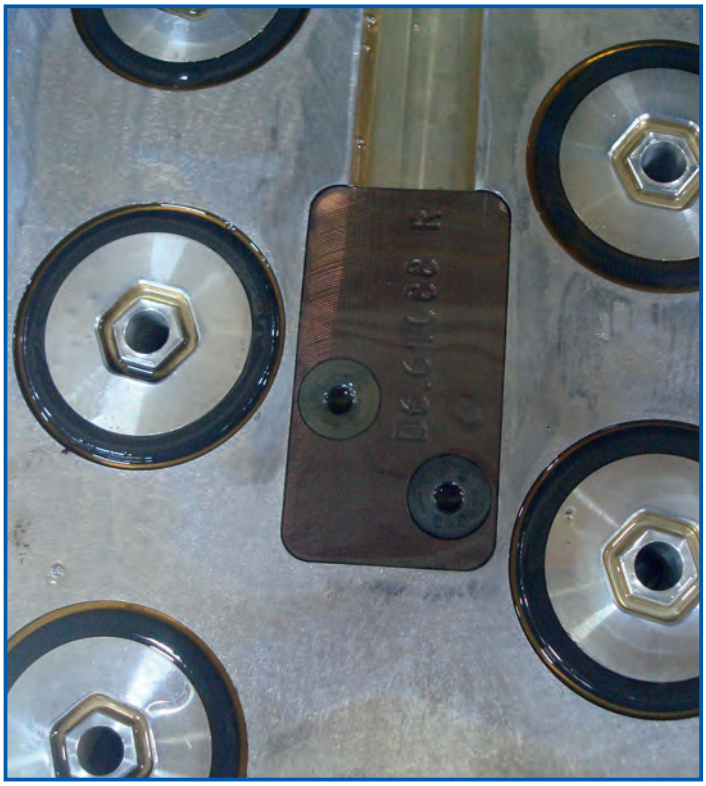
View into the press line 5 during maintenance

Trelleborg's production line 6

Dyn presses from the conventional to the new version developed by the technical consultant. With this modification, press operation turned out to be very successful, showing effects in terms of a thicker oil film, better oil distribution over the press surface and less oil leak flow that would decrease the efficiency of the process in the machine.

As a consequence, also the press in the second production line was equipped with the new modified Teflon pad version in 2018.

Trelleborg thanks Dr. Haupt for his technical assistance for the presses as well as for the yearly supervision of the maintenance works performed on both machines.



Reverse side of a new Al-plate version

New Teflon surface version after years of operation in the machine

FMH – The spare parts supplier for your Hydro-Dyn press

Nearly every company operating a Hydro-Dyn press is a customer of FMH – the spare parts supplier for these presses. All required spare parts are manufactured in the FMH workshop and then picked up by transport companies to bring them to customers all over the world.

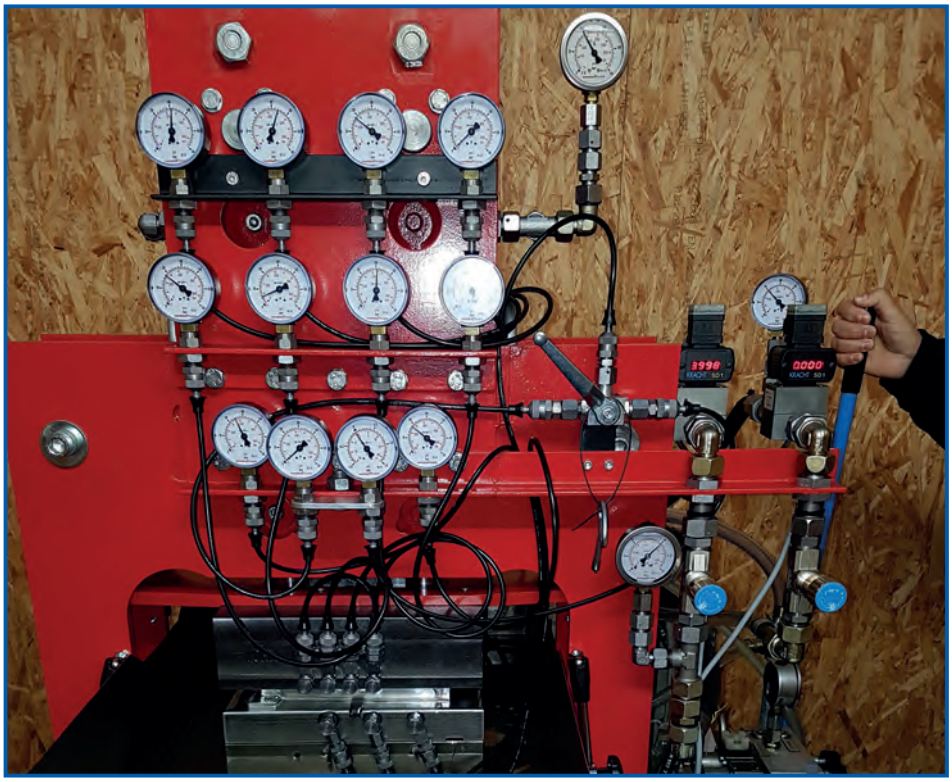
Guido Metzig / owner of FMH · Domenik Metzig · Jannik Metzig

The Company FMH

Guido Metzig is the owner and head of the company founded in 1999.

His elder son, Domenik Metzig, joined the company in 2019 after three years of apprentice training in sales and accounting.

In 2022, Guido's younger son, Jannik Metzig, joined the company as well.



View of the FMH test rig for fundamental investigations simulating the fluid flow in a Hydro-Dyn press

He had finalized his three years professional education as a mechanic in a paper manufacturing company.

With this team, FMH is well prepared for the professional challenges of the future.

In addition, FMH extended the field of business activities by sanding machines, especially for the BISON brand. A specialist in this sector, Mr. Frank Käß, was taken over from BINOS in 2019. He assists customers with his know-how and his experience gathered over many years of work in this field. Customers operating a BISON sanding machine are invited to use Frank's support by contacting FMH.

FMH is not only manufacturing spare parts for Hydro-Dyn presses – but is also engaged in the development of the Hydro-Dyn press system. In cooperation with Dr. U. Haupt, two test rigs were built, where the suction effect downstream from the heating platen nozzle could be proven. This important result formed the basis for the design of the new Al-plate/Teflon pad configuration.

Finally, FMH built another bigger test rig as shown in the figure below. This installation enables to study the silicone oil fluid mechanics around a Teflon pad. Measurements of the volume flow of in-feed and return flow as well as of static pressures from sensors on many measuring points on the Teflon surface are accomplished on this equipment.

Parameters like press pressure, heating platen nozzles and Al-nozzles, oil groove design in the Teflon parts and many other items are varied during the tests providing deeper insight into the characteristics of the fluid flow. Experimental data obtained in these tests are finally analyzed by several engineers engaged in this technical field.

FMH – The spare part supplier for your Hydro-Dyn press

The two steel belts in the Hydro-Dyn press are gliding on an oil lubricated Teflon surface under pressure through the machine. As no movable elements like roller bars or chains being typical wear parts are needed, this is an ideal solution.

In this type of press, other parts are subject to wear, mainly due to high temperature and thermal expansion of different materials such as plastic, rubber, steel, aluminum or plastic laminates. Other causes of wear are friction, pressure, flow effects or errors during assembly of the parts.

In general, the service life of press components is very different. O-rings, for example, have to be exchanged quite often (once or twice per year) to ensure satisfactory product quality. Other parts must be replaced when wear marks on the surface appear, oil leaks occur or when their function in the machine is either poor or no longer fulfilled.

FMH as your spare part supplier produces the parts on the basis of original drawings and many years of experience in the production of press components.

Rubber lip seals are elements required to avoid oil leaks on the machine. The following process is the key to a long service life of rubber seals and efficient application: pre-cooking of the lip seal and scraper material.

FMH has invested in equipment to pre-cook the rubber material in hot silicone oil over a longer time, which then expands less during its use in the press. Press users benefit from this treatment when using lip seals or rubber scrapers from FMH.

In the past, FMH has helped customers with urgent spare part requirements in many cases. As part of a small company, the FMH team is always motivated to do everything in its power to ensure fast production and delivery of parts.

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In der Wanne 10 · D-31832 Springe/Deister
Tel. +49 5041 / 620-828 · Fax +49 5041 / 620-829 · cell +49 172 / 6007322
e-mail fmh.produktion@t-online.de · web http://www.fmh-produktion.de

Volker Forberich – Pioneer of Hydro-Dyn

Volker Forberich

The following article is dedicated to Volker Forberich who demonstrated his creativity in designing the oil-lubricated Teflon surface of the Hydro-Dyn press. As this development focused on the press function's key point it has to be considered as the background for its success.

Volker joined BISON in 1980 to work in the construction department of the Hydro-Dyn press with the priority of construction of press heating platen and the design of Teflon pads. He is the father of the standard Teflon pad system of the press and was later involved in the development of today's modern versions.

First prototypes of the Hydro-Dyn press were designed with a gliding surface made of rubber material due to the low friction factors when in contact with oil and steel. But the use of this material had to be excluded after the first trials.

The next candidate as a solution to this technical key question was Teflon. This material turned out to be ideally suited for this application with an extremely low friction factor, when being operated with oil lubrication and a moving steel belt. The oil ensured the function of the heat source.

Again this background, the creativity of a design engineer was required, which was found in the person of Volker.

The following challenges had to be mastered by him:

- Forming an even Teflon surface from particular Teflon parts, providing the advantage of an exchange of single or various parts.
- Designing this machine area comprising materials with very different heat expansion factors under heat, such as steel, aluminum and Teflon.
- Designing the oil passage on the Teflon surface to ensure maximum uniformity in the press area combined with the lowest possible oil leakage through gaps.
- Designing the edge areas of the pressure surface in the machine, considering the fact that practically every press has a different product width and thus a different width of the Teflon area.
- Finding practical solutions for fixing the Teflon parts on the aluminum plates enabling easy installation and removal of such plates from the machine.
- Designing an efficient rubber sealing system to prevent oil from leaving the press area downstream from the oil collection system.
  It should not go unmentioned, that an efficient rubber scraper system had to be additionally designed in order to clean the steel belt from oil before it reaches the press drum surface.

Volker was the design engineer with all these questions on his desk. He had to be creative to find practical answers to all issues while constantly keeping an eye on low costs of the technical solutions.

The author would like to express his gratitude for Volker's close and friendly cooperation in the past. Numerous technical solutions in the above area based on the outstanding competence of Volker and his ability to work in a team were the key to the success achieved.

Acknowledgements

The editor would like to express his thanks to all authors of articles in this issue of **THE PRESS** for their contribution. Thanks are also due to all companies that cooperated with the editor in turning ideas for press system improvement to reality.

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Contact: Dr.-Ing. Ulrich Haupt

Kirchdorfer Straße 6 · D-30974 Wennigsen · Germany
Tel. +49 5103 927757 · Fax +49 5103 927758
Mobile +49 170 2855017 · uli.haupt@t-online.de
https://hydro-dyn-press-consultancy.de/ · info@hydro-dyn-press-consultancy.de

HOTLINE: Tel. +49 5103 927757 · Mobile +49 170 2855017