Advanced foils and suction box cover materials to cut costs and improve quality

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I wish to express my appreciation to you for this opportunity to talk about advanced foil and suction box cover materials for modern paper machines.

UHMW-HD-PE Drainage-Elements

Throughout the international paper industry, *UHMW-HD-PE* (Ultra-High Molecular Weight High Density Polyethylene) has established itself as the most widely used material for paper machine drainage elements, such as forming boards, foils, vacufoils, deflector blades, wet suction box covers, and felt suction box covers.

Pioneer Role of LERIPA

In fact, it was our company, LERIPA in Austria, which pioneered UHMW-HD-PE suction box covers in the early Sixties. *ROBALIT 61* was the first such material, we were the owners of international patent rights, and within a very short span of time, ROBALIT 61 had become a household word in virtually every paper-making country. Later, when synthetic forming fabrics began to replace bronze wires, we added the product lines *ROBADUR AND ROBADUR MUF.*

At our works in Austria, we improved the base: polyethylene material by alloying it with cross-linking agents to increase its mechanical and chemical resistance, and with the lubricating agent *MOLYKOTE* (MOS_2) to reduce its coefficient of friction. We also set up the machinery necessary to produce elements meeting most extreme requirements: We are the only manufacturers in the World to have sintering presses more than 10 metres long, in order to make components without welded seams or joins even for the widest paper machines in operation or in the design stage, and we have cnc-controlled units to drill or mill any suction box cover perforation pattern fully automatically.

Drainage Elements are Important Cost Factor

In recent years, however, new paper-making technologies, new types of paper machines and machine clothing, higher machine speeds and the use of more abrasive stock or fillers resulted in an accelerated search for new, more economic foils and suction box cover materials distinguished by greater resistance to wear and easier maintenance. Drainage elements had become an *important cost factor*. Initial cost for one set of UHMW-HD-PE components (comprising say one forming board, four deflectors, six foil boxes with four foils each, two vacufoil boxes, seven flat suction box covers and four felt suction box covers as well as sealing strips and doctor blades) for a modern paper machine having a wire width of 4-5 metres will at least be US$ 15.000—To this sum, installation, resurfacing and maintenance costs must be added.

In line with developments mentioned, many mills were faced with severe reductions of average component life of their foils and suction box covers. To go into detail, reasons could be the introduction of synthetic forming fabrics without changing some of the machine parameters, a machine rebuild resulting in increased machine speed, the use of more abrasive fibres such as bagasse or stock containing a higher percentage of impurities from bad quality fillers, grit, dirty waste paper or water containing sand-particles. If for example, component life is reduced from 1 year to 6 months, annual component costs would rise to US$ 30.000,—, with rising costs for resurfacing and maintenance.

In addition, drainage elements not suited for stepped-up paper machine requirements may have an adverse effect on wire or felt life if abrasive particles become embedded in the surface of the elements. As this may lead to severe damage to wires or felts, it would greatly add to costs.

Advanced Drainage Elements Materials

Advanced suction box cover materials developed with modern paper-making conditions in mind, fall into the following categories:

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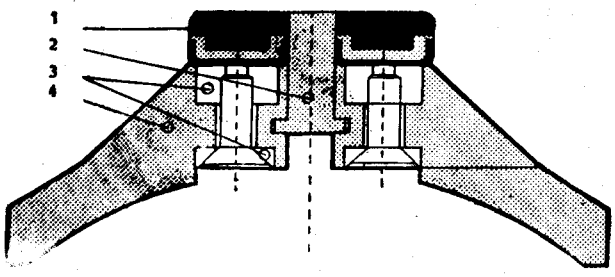


Illustration No. 1
Cera nic Felt Sucction Pipe Cover (One Slot)
1–Super Ceramic
2–PE Deckle Slide
3 -Stainless Steel Profiles
4–PE Base Plate

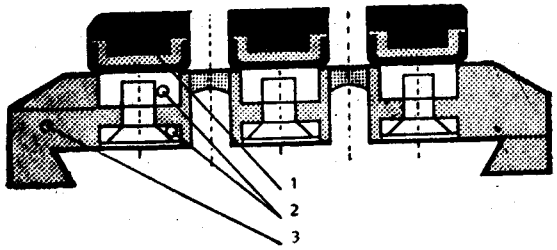
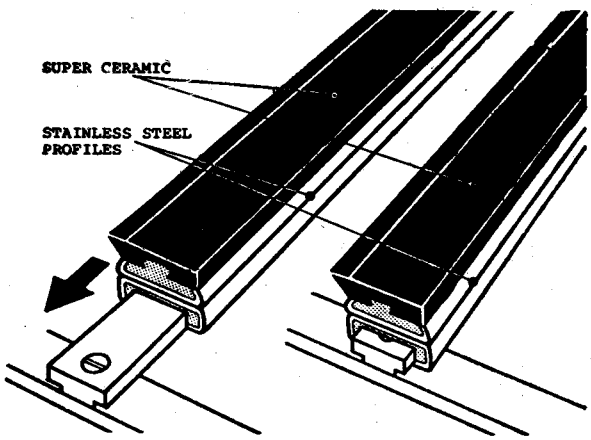


Illustration No. 2
Ceramic Felt Suction Box Cover (Two Slots)
1–Super Ceramic
2–Stainless Steel Profiles
3–PE Base Plate



Illnstration No. 3
Ceramic Foils

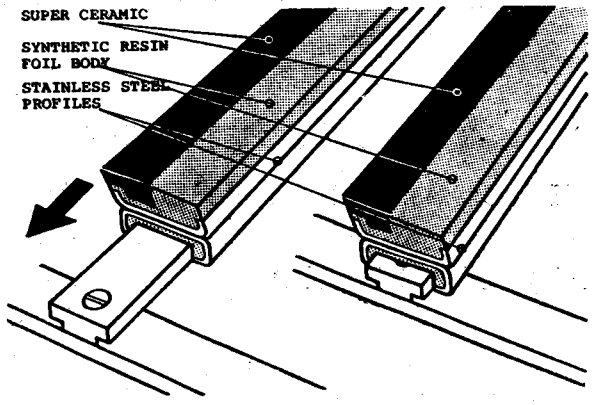


Illustration No. 4
Economy Ceramic Foils

Reinforced UHMW-HD-PE Elements

ConVentional Ceramic Elements

New Self supporting Replaceable Full-length Ceramic Elements

Reinforced UHMW-HD PE-Elements

In the late Seventies, a number of manufacturers of paper machine drainage elements began to experiment with various alloy additives, in order to make their products more resistant to wear.

Our answer to this problem is *ROBAGLAS*, which is made up of UHMW-HD-PE alloyed with MOLYKOTE and reinforced with silicon compounds, essentially *micro-beads* of abrasion-resistant *glass*. Under abrasive paper-making conditions, the wear-resistance of ROBAGLAS elements is often increased as much as four-fold, and in special cases even more.

While it would be incorrect to call a glass-reinforced polyethylene material "ceramic" ROBAGLAS does in fact take a *position* half-way *between* conventional *polyethelene* and *ceramic components*. ROBAGLAS gives full satisfaction in many installations where ordinary polyethylene. covers or foils showed insufficient wear resistancet What is even more gratifying to know is tha- ROBAGLAS costs only a little more than conVen tional polyethylence elements and is much less expensive than ceramic covers. Just to give you an idea of the price differentials in existence: If polyethylene costs 100, the price for ROBAGLAS would be around 125 and for ceramic around 1500 !

The advantage of the increased abrasion resistance of ROBAGLAS, combined with maximum wire protection, is particularly noticeable where plastic were or synthetic forming fabrics are used in connection with a *high percentage of abrasive fillers* or waste paper containing a lot of sand or grit. Typical applications are forming boards, foils, deflector blades, wet suction box covers and flat suction box covers. ROBAGLAS also supersedes stainless steel in felt suction box covers, and is also used for doctor blades.

ROBAGLAS References

In order to show what ROBAGLAS can do I should like to give a few references of ROBAGLAS installations :

On a machine producing fibre and mineral board in Switzerland, operating at a speed of 7, 5 m/min with synthetic forming fabrics, the life of polyethylene covers between resurfacings was one year. ROBAGLAS lasted for almost two years.

Component life of a modern treble wire board machine in Finland operating at a speed of 400 m/min was about 9 months.

After all foils, vacufoils, suction box covers and felt suction box covers were replaced by ROBAGLAS, component life increased to 30 months.

In a Danish paper mill producing greaseproof paper at machine speeds of about 190 m/min, conventional drainage elements experienced 10 mm wear over a 6 month period. When ROBAGLAS elements were fitted, wear was reduced to 2 mm over the same period of time.

ROBAGLAS elements are *fitted* or *removed* in a paper machine in exactly the same way as conventional plastic covers. Equally, they are *resurfaced* in much the same way, but we recommend the use of tools fitted with hard-metal cutting edge.

Our advice to paper mills considering the installation of ceramic drainage elements is to have a good look at ROBAGLAS first.

Conventional Ceramic Elements

Conventional Ceramic Suction Box Covers and *Foils* made of sintered aluminium oxide or silicium carbide had been known to the international paper industry for more than 25 years. Their use, however, was *restricted*, both for reasons of technical limitations and cost.

By necessity, conventional ceramic ceramic are made up of short ceramic segments. These must be *hand-fitted by skilled fitters to rigid supports*, usually reinforced stainless steel suction or foil boxes, newly made for the occasion and provided with *special clamping arrangements* to accept the ceramic segments. All these items must be added to the cost of the ceramic material as such.

once fitted to the machine, conventional ceramic suction box covers or foils cannot be removed for maintenance, cleaning or replacement. The ceramic segments are *very brittle* and highly prone to break or splinter under mechanical or thermal shock, or under deflection. For certain materials, a rate of deflection of as little as 0.2 mm/m must not be exceeded.

New Self-supporting Repraceable Full-length Ceramic Elements

For these reasons, the conventional ceramic technology must be considered obsolete. The future belongs to *replaceable, full-length ceramic* suction box covers, foils and other *elements* to be installed on existing suction or foil boxes, with no need to rebuild supports or fastening systems.

Our *ROBAXYD Ceramic Technlogy* provides self-supporting, diamond-hard ceramic elements in one piece, the length of which equals machine width. In accordance with our new concept, we supply ROBAXYD Suction Box Covers, ROBAXYD Felt Suction Box Covers as well as ROBAXYD-ECONOMY Foils.

All ROBAXYD Elements are fitted with a new type of ceramic material which we call *Super Ceramic*. This is the reason why ROBAXYD covers or foils can support a much higher rate of deflection without cracking or breaking.

Super Ceramic Quality

The quality of sintered aluminium oxide ceramic depends on a variety of conditions, among them *purity* (=content of aluminium oxide Al_2O_3), *density* (=content and size of pores), *form and size of ceramic crystals, bond between crystals, surface finish* and *manufacturing tolerance.*

The three key factors are *purity, density* and *crystals size*: The higher purity and density and the smaller crystal size, the better the quality of the ceramic material for paper machine applications.

Low purity (= low aluminium oxide content) signifies the presence of non-aluminium oxide components, which have much less strength than the Aluminium oxide crystals : Consequently, the ceramic material has less cohesion and breaks more easily. *Low density* indicates the presence of pores in the material which may permit the embedding of abrasive particles during paper machine operation. *Big*

c *rystal size* does not permit a good surf.ce finish, as big crystals are much more likely to break out during surface grinding, leaving a bigger hole than a small crystal.

Purity of our *Super Ceramic material* is 99.8%. Density is 3.95 (which is 99.28 of theoretical density of aluminium oxid: of 3.98). *Crystal size* is 2 microns. These extraordinary values mean that our Super Ceramic is much more cohesive and considerably less brittle and less prone to damage than conventional ceramic materials.

Surface finish of ROBAXYD Elements is Ra=0.4 my. Our ROBAXYD Ceramic Technology is protected by international patents or patent applications.

ROBAXYD Ceramic Foils

ROBAXYD Ceramic Foils o: D flector Blades are made up of finished ceramic segments covering the *entire foil surfac:* firmly bonded to a rigid chrome-nickel steel profile forming a double U. The lower U is fitted with a plastic lining which receives a T-bar groove adapted to the T-bars of the foil boxes existing in the paper machine. Alternative linings can be provided if the boxes or supports do not have T-bar mountings.

ROBAXYD-ECONOMY Foils

ROBAXYD-ECONOMY Ceramic Foils follow the same construction principle as ROBAXYD Ceramic Foils, but only the *wire-bearing part* of the foil surface is made of *Super-Ceramic.*

ROBAXYD-ECONOMY Foils do not cost much more than insert foils, yet they are full fledged ceramic drainage elements.

ROBAXYD Foils are available in widths of 50 mm (2″) and 65 mm (2.1/2″), ROBAXYD-ECONOMY Foils in widths of 50 mm (2″), 65 mm (2.1/2″) and 75 mm (3)″.

The *ROBAXYD Foils*, *ROBAXYD-ECONOMY Foils* and *D.flectors* are mounted on existing foil boxes or supports as easily as polythyelene elements. There is no need to rebuild boxes or supports or to call on the help of outside fitters. The ROBAXYD elements can be removed just as easily, should this be necessary for cleaning (pitch !) or changing of foil angles.

As our Ceramic Elements do not wear and the parameters of a foil table are not subject to constant change, ROBAXYD and ROBAXYD-ECONOMY Foils guarantee *uniform drainage across sheet width* and also in relation to preceding and following foils, they increase drainage and prevent wire or sheet marking.

Benefits Versus Costs

In this way, our Ceramic Foils make an important contribution towards *upgrading a paper machine performance* and *improving production quality,* factors to be taken into consideration when weighing the benefits of a ceramic installation against costs.

When it comes to other types of replaceable single-unit ceramic foils on the market, it should be borne in mind that our ROBAXYD Design with its stainless steel profiles is a much more solid construction, and that our ceramic segments are much longer which means a lesser number of ceramic joints in a foil.

ROBAXYD Suction Box Covers and Felt Suction Box Covers

ROBAXYD *Ceramic Suction Box Covers* in accordance with our new concept are made up of full-length ceramic-steel combination elements mounted on a UHMW-HD-PE Plastic base plate. *Felt Suction Box Covers* consist of two or three ceramic steel elements again mounted on UHMW-HD-PE Plastic base, which fits the existing felt suction box, felt suction tube or Uhle Box.

ROBAXYD Suction and Felt Suction Box Covers are we feel, a very interesting combination of ceramic surfaces with easy-to-install plastic base plates. The base plate is machined to fit the existing suction box or tube. There is no need for the paper mill to rebuild boxes or tubes or to adopt a new fastening system which would be necessary for suction box covers of conventional ceramic design.

Our range of ROBAXYD Ceramic Elements includes *Curved Inverted Box Covers* for modern twin wire machines (Bel Bond Former).

Our ROBAXYD *Ceramic Felt Suction Box Covers* have given excellent results in a great number of installations in Europe and Overseas.

All told, there are more than 160 ROBAXYD Ceramic installations in operation today. While costs for ceramic installations are necessarily high, ROBAXYD Elements cost relatively less than conventional ceramic components.

Influence of Suction Box Cover Design

Suction box cover design is a very important factor in minimizing operating costs of a paper machine. The open vacuum area of a suction box cover determines drainage capacity as well as couch load.

It has been determined that the reduction of slot width of slot perforation patterns results in important power savings as the wire (particularly a synthetic forming fabric) is no longer drawn into the slots by the vacuum.

A series of tests was carried out in a German paper mill producing art paper 50–170 g/sq.m at machine speeds of 130-300 m/min synthetic wires. There are 8 suction boxes, having 7 slots each 20 mm wide. The machine is equipped with a modern Combi-Press.

First, the mill established the relationship between suction box capacity, power consumption, press capacity and dryness. When four suction boxes were shut off, power consumption of the couch roll dropped from 26.3 to 14.1 KW (-46%). and of the forward drive roll from 39,2 to 20 KW (-49%), whereas dryness after the Combi-Press was only reduced from 34.7 to 34% (—2%). This result was possible because of the large capacity of the Combi-Press which served to remove excess humidity not drained by the wire part.

Encouraged by these tests, it was decided to change the slot perforation pattern of all suction box covers ; Slot width was reduced to 12 mm and the number of slots was increased to 10. The resulting loss of open vacuum area was quite acceptable as there was virtually no reduction in dryness. On the other hand, the drawing-in effect of the wire was minimized which lead to a reduction of the power consumption of the couch and forward drive motors of 32%. It is remarkable what savings can be realized just by making simple changes of suction box cover slot patterns.

Conclusion.

ROBAGLAS, ROBAXYD and ROBAXYD-ECONOMY installations offer an important contribution towards greater paper machine efficiency and better paper quality. Even under most abrasive conditions, wear problems are eliminated, power requirements are reduced and drainage is improved.