WIRE PART TECHNOLOGY
The involvement of fabrics and dewatering equipment

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ABSTRACT

Part I : The advancement of fabric designs from 3, 4 & 5 Shaft Single Layer to the numerous 7 and 8 Shaft Double Layer configuration is presented. The achievements through a better understanding of frames, frame length, fibre support and drainage and the development of F.S.I. and D.I. Indices are discussed. Retention v. Frame Length, F.S.I. and D.I. relationships are compared with machine experience which confirm the value of these indices in predicting relative performance. Triple Layer design is reviewed and possibilities for the future with trends towards improved fibre support and drainage.

Part II : Equipment development from foil to vacuum controlled units for the three stages of dewatering are outlined The principles applied are discussed using current technology with the Isoflos in the forming area, low vacuum Duoflo in the high water removal part, through to the graduated high vacuum section. The importance is stressed on a water management approach in assessing the table accurately for the application of precision dewatering tools.

INTRODUCTION

In the long history of papermaking the last quarter of a Century has seen a dramatic change in wet-end technology. The transition from metal wires to synthetic fabrics, coupled with the rapid development in the dewatering field, has had a profound effect on papermaking in terms of production, quality and energy savings. However, there is still considerable potential between breast roll and couch on fourdriniers and twin wire machines with a pre-forming section, for further improvement and savings.

FABRIC DEVELOPMENT (PART I)

The changeover from metal wires to synthetic fabrics started in the 1960's and was a challenge to both supplier and papermaker alike. The immediate benefits were ease of handling and fabric life but the drainage characteristics, power requirements and cross-direction and machine-direction stability caused some concern.

FIRST GENERATION.

A natural starting point was to use designs similar to the traditional 3 shaft metal twill wires from which it soon became apparent that stability in both machine and cross-directions, required extensive field work and research and development. The behaviour of these new elastic products had to be understood, along with particular machine conditions. We no longer had a high modulus low stretch product.

For many applications where a fine mesh was necessary, the 3 shaft twill design was quickly superseded by the Monoflex 4 shaft satin twill. This could be specified with the long cross-direction knuckles on the machine-side, for optimum wire life, or alternatively with the long cross-direction knuckles on the paper-side for optimum fibre support.

The difference in paperside strand profile produced totally different drainage characteristics between the two sides, requiring a fuller explanation of fabric behaviour which will be explained later in the paper.

5 shaft single layer fabric designs soon followed, and like the 4 shaft designs good drainage and fibre support were achieved when applied using the long cross-direction knuckles on the paperside and improved life when the fabric was inverted. These designs have been very successful, particularly for the Kraft, Linerboard and Tissue applications.

Fig. 1 illustrates three fabric constructions which formed the basis of the First Generation of synthetic fabrics and there are still many applications today where these designs are doing a good job, meeting all papermaking requirements.

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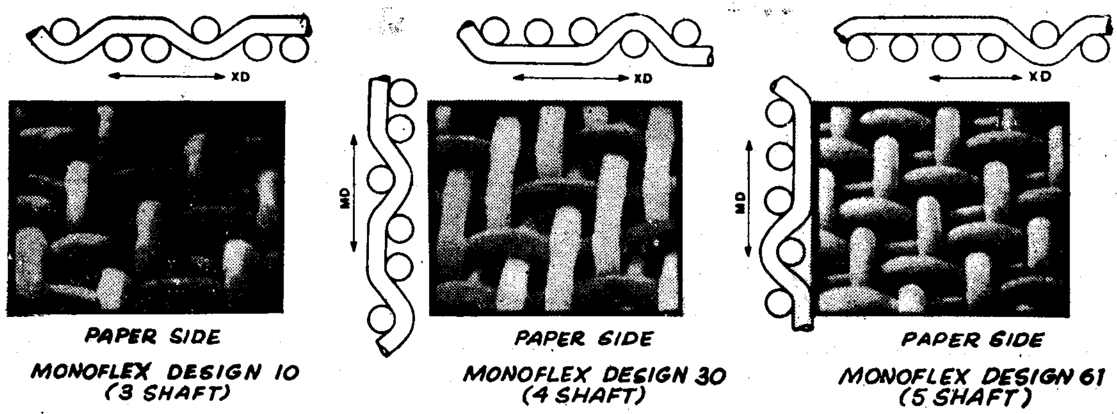


FIG. 1 PRINCIPLE FIRST GENERATION SYNSHETIC DESIGNS

One of the similarities between these single layer designs and metal wires is their direct drainage— "straight through" square or rectangular openings in the fabric. As a consequence the percentage open area was naturally used initially as a measure of drainability (see Fig. 2 a). It was soon realised that this was not representative and the fabric's resistance to air flow against a fixed back pressure, was found to be a more reliable method of establishing the relative drainage characteristics between specifications. Air permeability is still recognised within the paper industry as a measure of drainage, although it is now known that this is only part of the drainage equation, which will be discussed in more detail in the drainage section.

SECOND GENERATION

These designs emerged during the 1970's and consisted of high machine-direction strand fills, (100%+) with a cross-direction arrangement of strands stacked in pairs, with knuckle profiles according to the machine-direction strand configuration. Fig. 3 shows three typical double layer Monoflex 2000 designs, which have been used extensively across a wide range of grades.

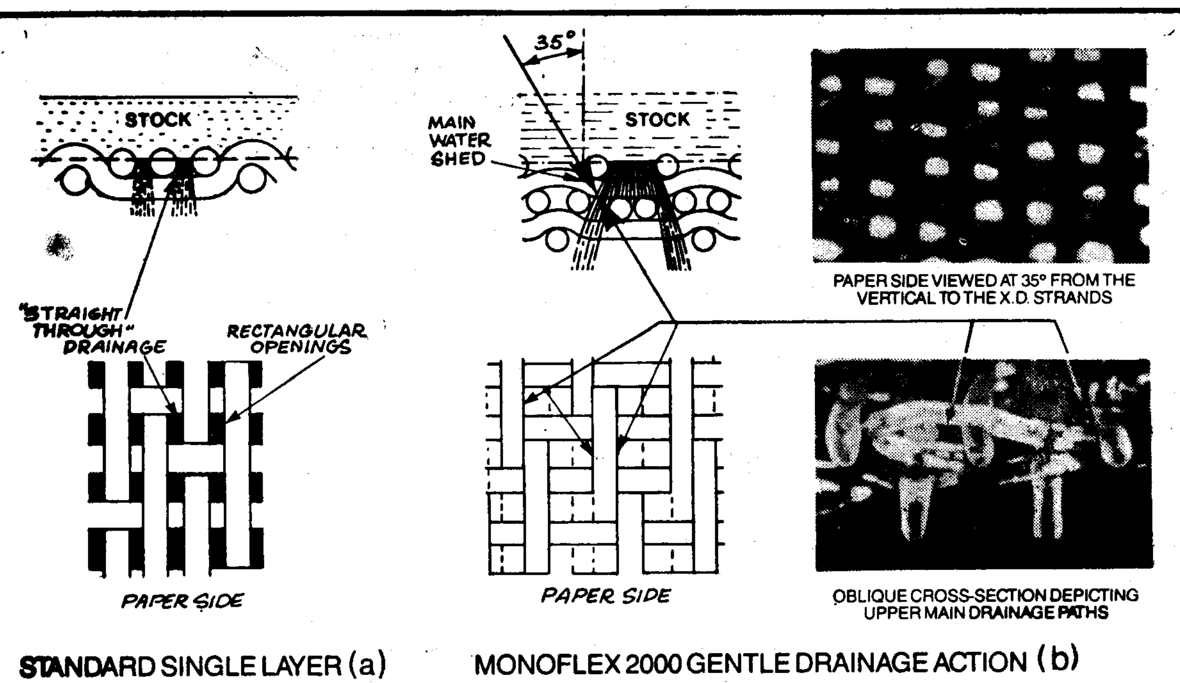


FIG 2. FABRIC DRAINAGE DIAGRAMS

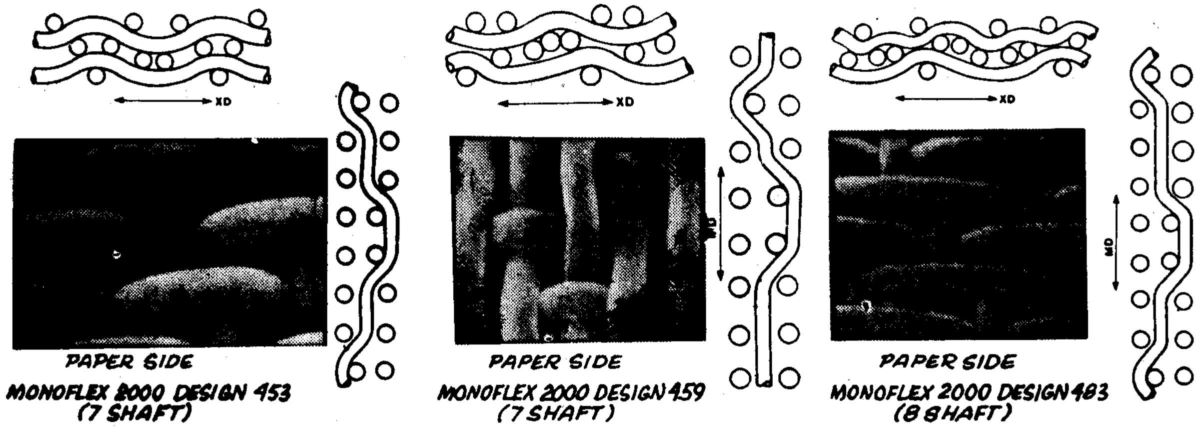


FIG 3. TYPICAL SECOND GENERATION SYNTHETIC DESIGNS

This innovation opened up a totally new area involving research and development and extensive field trials. What had evolved was a two sided fabric calling for further development of materials, strand selection, and an assessment of design configurations. These new designs completely changed the drainage characteristics, improving wire mark and cross-direction profile (stiffness) which benefited many fast wide machines. The presence of two layers of cross-direction strands allowed the paperside to be designed for papermaking, i.e. fibre support and wire mark etc, with the machine-side designed for additional cross-machine stiffness and fabric life. The requirements for certain physical properties are also taken into account.

We now have increased caliper, and the resistance to air flow has increased, owing to the 100% + machine-direction strand fill and the strand configuration, hence lower air permeability values. There is no "straight through" drainage and as a result openings can only be seen at an angle of approximately 35° from the vertical. The location of the main drainage paths act more like a waterfall, thus providing a more gentle drainage action, as shown in Fig. 2b, but the capability for removing water has increased in most cases, to more than that realised with the single layer designs.

This phenomenon is the result of a large void volume within the structure and the fibre support afforded by the particular design. As designs have developed, the relationship between the paperside top surface support the strand knuckles provide, particularly in the cross direction, has a significant bearing on the fabric's drainage potential from breast roll to couch. The less fibre embedment the lower the resistance to passing water through structure, during the various stages of dewatering, which can also result in less power by reduced drag

Current experience with fine mesh double layer (Monoflex 2000) for S.C. Magazine and high quality low grammage grades, has produced good results, with a balanced design for good drainage distribution and fibre support, which satisfies the critical properties of formation, smoothness and wire mark.

A further development of the Second Generation concept has been with low machine-direction strand fill designs, which have paperside fibre support properties similar to known single layer designs. Fig. 4 shows Monoflex design 422 depicting the principles, which feature a long cross-directing machine-side strand knuckle of substantial size promoting fabric life, cross machine stability and sheet profile. The increased caliper and low-machine-direction strand fill provide high drainage characteristics with good fibre support. Kraft and Linerboard machines have benefitted from these designs with good retention and life.

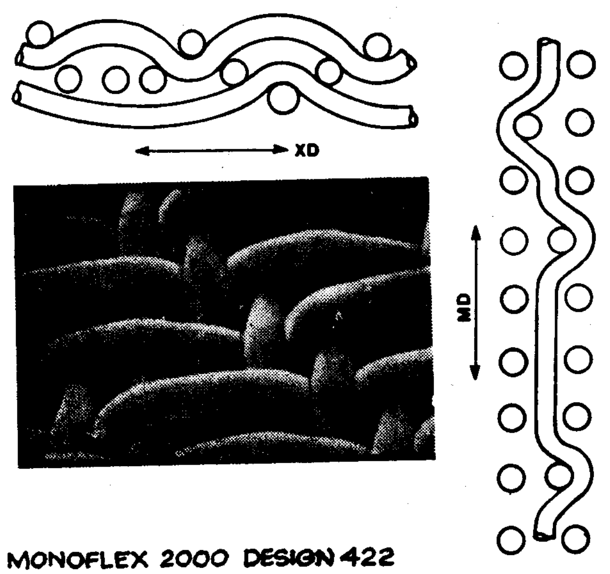


FIG 4. HEAVY DUTY DESIGN FOR KRAFT & LINERBOARD APPLICATIONS

FABRIC TECHNOLOGY

The Advancement of Monoflex 2000 designs with applications covering most machines and grades demand a better understanding, owing to some of the arduous machine conditions and the numerous designs available Therefore, methods of predicting their performance are essential.

Fig. 6 outlines the requirements for a good forming fabric today.

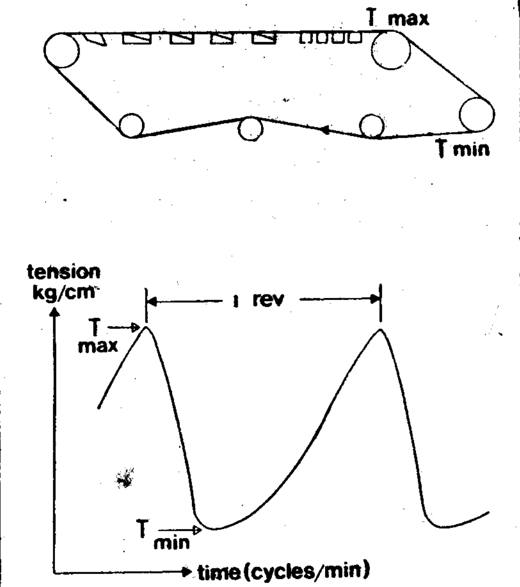


FIG 5. THE MODE OF VARIABLE TENSION DURING ONE CYCLE OF A FOURDRINIER MACHINE

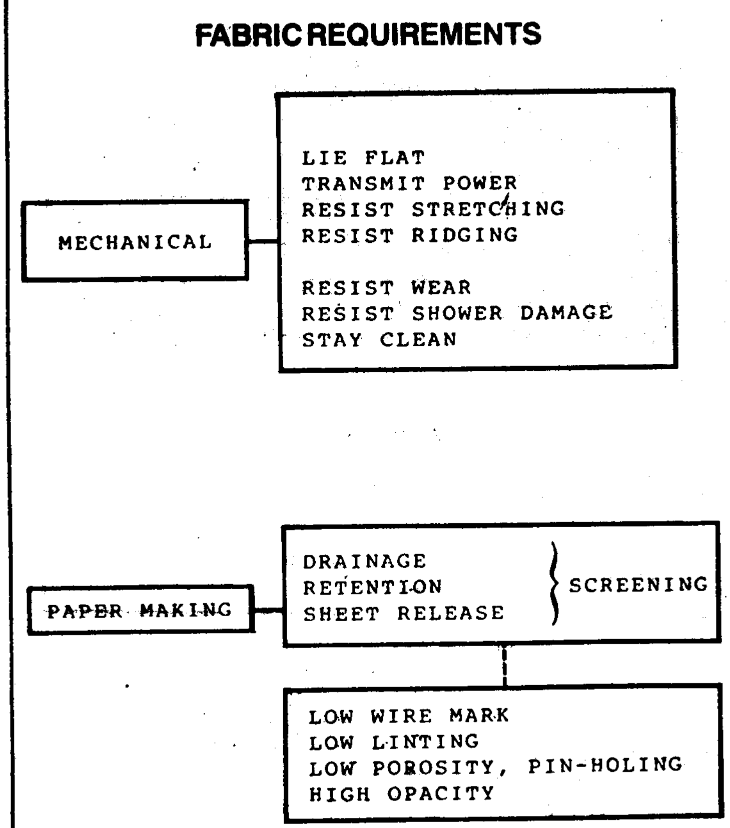


FIG 6. A MODERN FORMING FABRIC SHOULD SATISFY THESE CONDITIONS ACCORDING TO APPLICATION

MACHINE TENSIONS AFFECTING FABRIC LENGTH

As the applications for fabrics has expanded covering fast, wide and high loaded machines, it has become necessary to build into the specification an allowance for such conditions as, stock temperature, running tension and pulsating drag loads. Fig. 5 shows a typical paper machine cycle indicating the variation in tension, from the normal running tension to a maximum over the flat boxes, prior to the driven couch and forward drive roll. The elasticity of fabric strand materials under pulsating loads cause length changes for which an allowance must be made in the specification. Allowances must cater for the extension to normal running length, plus an appropriate adjustment to accommodate the effects of the magnitude of the pulsating load.

In some instances with a limited stretch facility installation tensions have to be high to prevent stretching off the machine. The need for accurate machine data relating to running tensions, drag loads etc, is essential if the fabric specification is to be right for such critical applications.

FRAMES AND FRAME LENGTH

It has been established (Ref :1 & 2) that the open area in the paperside, formed by the space between the cross-direction strands and the adjacent machine-direction strands, referred to as a FRAME, has a significant effect on the way in which fiber is supported and fibre embedment. Fig 7 shows the marked difference in the shape of the frames between two designs, the latter having a uniform machine-direction frame length. The white areas in Figs. 8. & 9 shows the actual frames in the top surface of this designs.

A Laboratory study (Ref :3) showed a relationship between frame length and fibre retention, see Fig. 10 with the retention increasing as the frame length decreased. This has been confirmed by machine surveys of fourdrinier and twin wire machines, the details of which are shown in Figs. 11 & 12. The shorter frame length corresponds with the double layer fabric designs. The results in Fig. 12 were after both stations had been clothed with double layer fabrics—VF and BB were twin wire machines—A,B & C were the performing type.

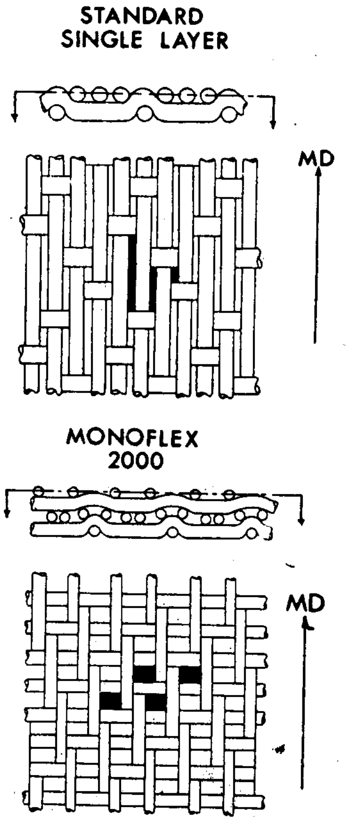


FIG 7. SCHEMATIC OF FRAMES IN SINGLE AND DOUBLE LAYER FABRICS

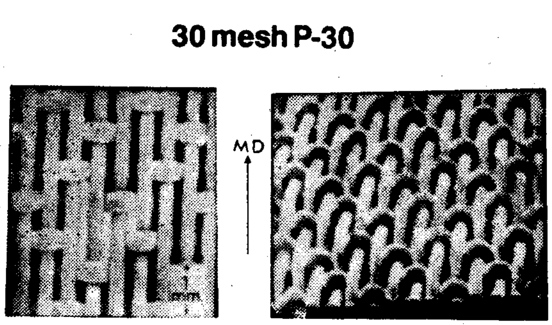


FIG 8. ACTUAL FRAMES IN 4 SHED SINGLE LAYER

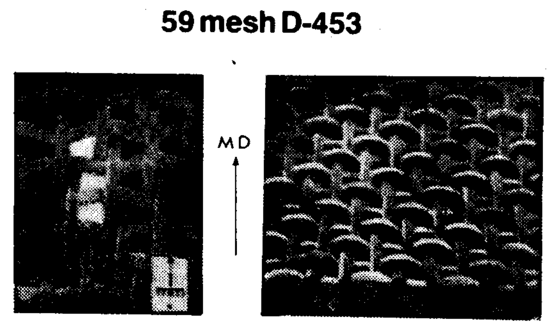


FIG 9. ACTUAL FRAMES IN 7 SHED DOUBLE LAYER

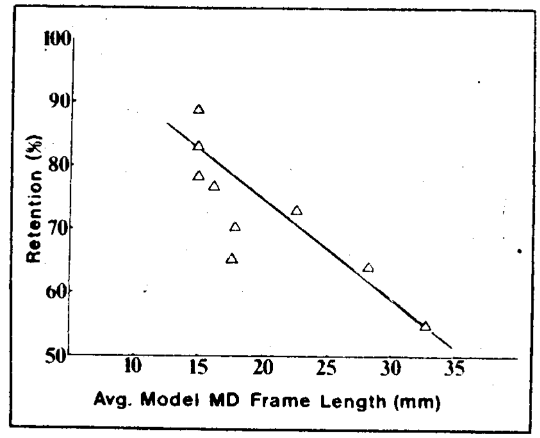


FIG 10. THE RELATIONSHIP BETWEEN RETENTION AND FRAME LENGTH

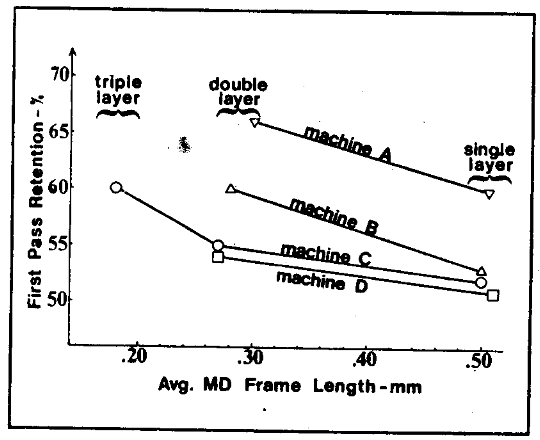


FIG 11. RETENTION AS A FUNCTION OF FRAME LENGTH ON FOURDRINIERS

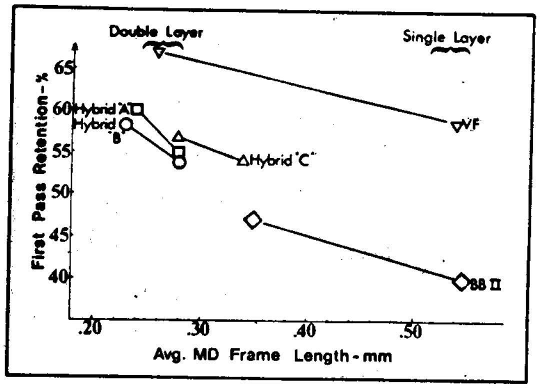


FIG 12. RETENTION AS A FUNCTION ON FRAME LENGTH ON TWIN WIRES AND HYBRIDS

FIBRE SUPPORT

Research on fibre support for moderate machine-direction orientated fibre, (Ref : 4 & 5) was followed by Beran's study, which provides an equation for fibre support based on a support grid to define the properties (Ref : 6). Fig. 13 illustrates the differences between the support grids for single, double and triple layer fabrics indicating the support given to a 3 mm fibre. The equation shown is known as the fibre support index :–

$$F.S.I. = 1.69\ (a.\ Nm + 2.b.\ Nc) \quad (1)$$

Nm denotes C.D. strand count (mesh)

Nc denotes M.D. Strand count

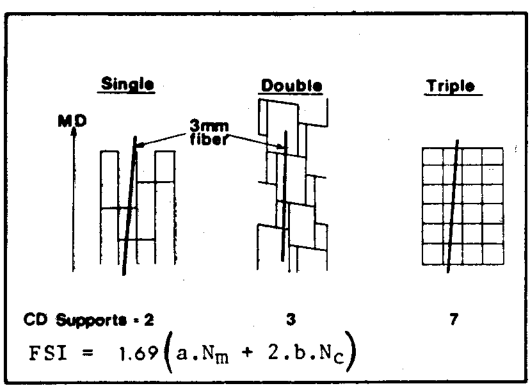


FIG 13. COMPARISONS OF SUPPORT GRIDS FOR DIFFERENT FABRICS

The factors a & b are derived from the support grid, which can be drawn for all designs based on the smallest repeat in both machine-direction and cross-direction of the pattern. Figs. 14, 15 and 18 shows the fibre support grid super-imposed on the machine direction and cross-direction strands for single, double and triple layer designs. The formula applied to different designs and meshes forms a range of FSI values as shown on the bar chart (Fig. 16). As expected the finer meshes in the same design have higher FSI values with 70 cm double layer design 459 ranking above others, apart from the exceptionally high value for the triple layer design. The FSI values affect wire mark, sheet release and the cleanliness properties of different fabric designs.

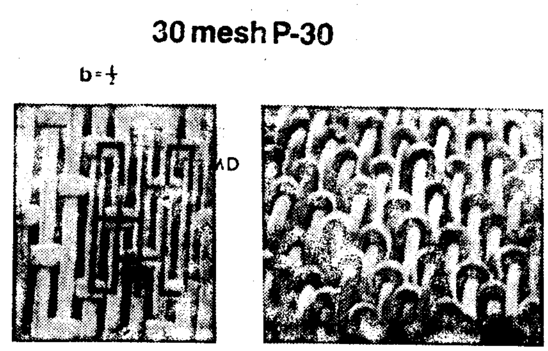


FIG 14. FIBRE SUPPORT GRID FOR 4 SHED SINGLE-LAYER FABRICS

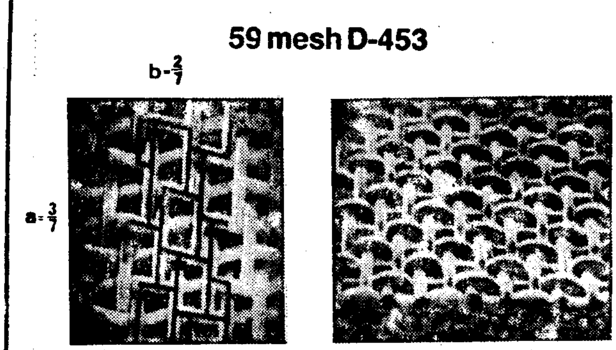


FIG 15. FIBRE SUPPORT GRID FOR DOUBLE LAYER FABRICS

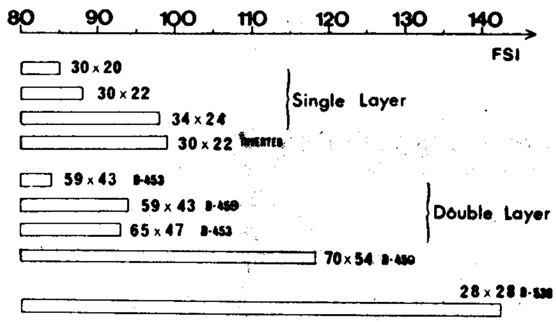


FIG 16. EXAMPLE VALUES OF F.S.I.

The amount of fiber embedment depends on F.S.I. and the profile of the cross-direction strands which provide top surface support. This also has an effect on the way in which the fabric drains.

DRAINAGE

Using air permeability as a measure of a fabric's drainability does not explain why—

a) A single layer design (Fig. 8) has totally different drainage properties when inverted but the initial air permeability remains the same.

b) Most double layer designs have a lower air permability than single layer designs although their drainage properties have improved (Fig. 9).

This question leads to another important use of Beran's support factors which are used in defining a draining index (D.I.). (Ref : 7). The relationship between the top surface cross-direction strand fibre support and the initial air flow through the fabric, provide a relative index of drainability as follows :—

$$D.I. = b \times Nc \times V \times 10^{-3} \times 2\ 54 \text{ --- } (2)$$

V denotes air permeability in C.F.M.

b & Nc as equation—(1)

Fig. 17 compares three important properties which affect the performance of the fabric—

initial A.P. F.S.I. and D.I.

and reflects the difference between single and double layer fabrics. we can now explain why the characteristics of single layer designs, when inverted provide a higher drainage and why double layer drainage is better than single layer.

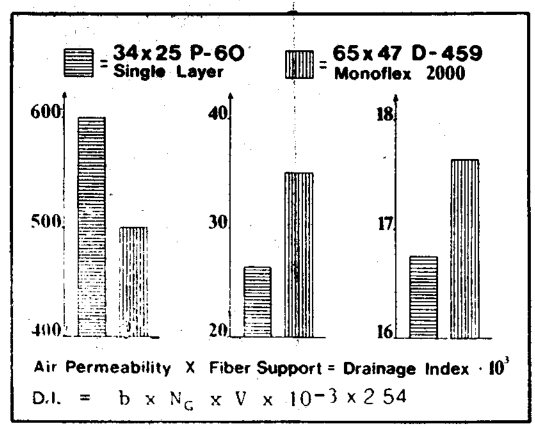


FIG 17. EXAMPLE OF D.I. COMPARISON BETWEEN SINGLE AND DOUBLE LAYER

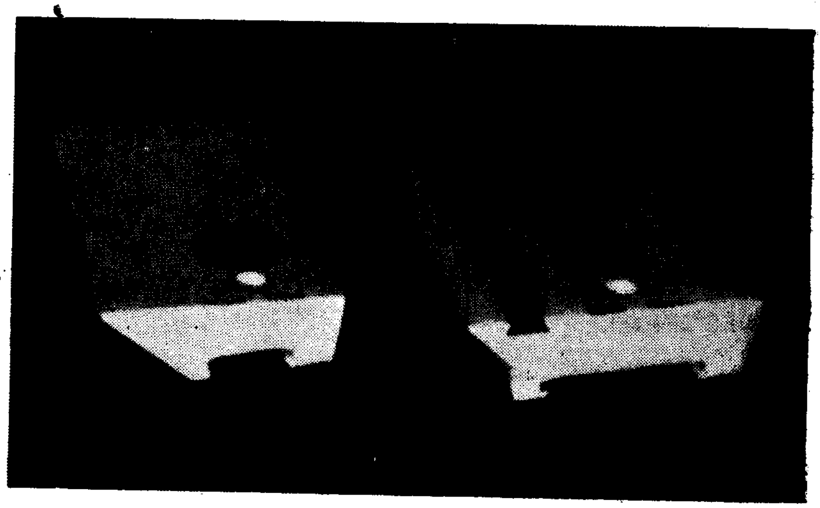
There is a marked difference in the F.S.I. and D I. values between the two sides of a standard single layer fabric. It is the high value of the 'b' factor in the equation for the inverted design, resulting from the long paperside cross-direction strands knuckle, which provides the fiber support and a short uniform frame length that reduces fiber embedment. Together these features promote the superior drainage characteristics of this mode.

The same is true for double layer fabrics which have high F.S.I. and D.I. values These examples are based on actual paper machine experience where high drainage has been observed in both cases.

By the skilful use of these indices and experience it is possible to predict more accurately a fabric's characteristics. Therefore, fabrics can be designed to a specified F S.I. and D I. which enables the comparative performance to be forecast under known machine conditions.

FINE DOUBLE LAYER

As a consequence of a better understanding of fabric construction, there has been a development in double layer design involving additional paperside



a) High density polythene foil

b) High density polythene foil with Tungsten Carbide insert

c) High density polythene foil with ceramic insert

d) High density polythene foil with high quality ceramic nose

FIG 19. VARIOUS FOIL DESIGNS ALL SLOTTED FOR TEE BAR MOUNTINGS

cross-direction strand with a high topside profile which provide improved fibre support. The configuration permits a high paperside cross-direction count and a very short regular frame length which reduces fibres embedment.

These are features of Monoflex JDL as shown in Fig. 27 where details of fabric paperside surface, machine-direction profiles are illustrated (a).

The short frames are indicated in white (b) and the superior values of both F.S.I. and D.I. are related to double layer (c) and (d).

THIRD GENERATION

A third generation (Monoflex 3000) has emerged during the early 1980's consisting of a fine top mesh and a coarse bottom design, woven simultaneously with appropriate connecting strands to achieve a composite structure. The principle is to have a top fabric design for optimum paper making characteristics, whilst the underside is designed for life and stability. The choice of a plain weave paperside provides excellent fibre support properties, high drainage and a balanced wire mark. The symmetrical knuckle pattern of both the cross-direction and machine-direction strands, reduce the "eye-catching" wire mark and provides a uniform drainage distribution. Fig. 18 shows a typical fabric construction and the paperside pattern illustrates the balanced square design.

28 mesh D-530

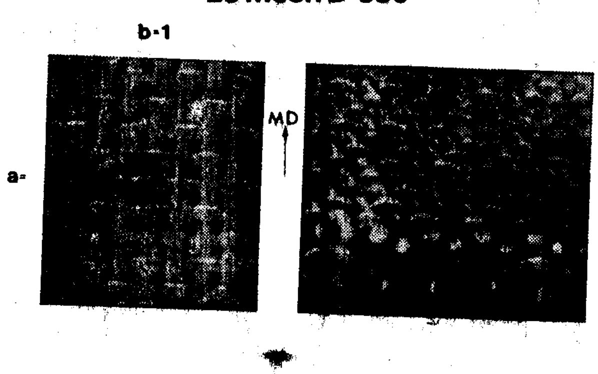


FIG 18. FIBRE SUPPORT GRID FOR TRIPLE LAYER

The heavy duty applications for Kraft and Linerboard have seen encouraging results, whilst their fine mesh applications which are more exacting, had mixed results initially. Current research and development is now showing promising results.

The development of this concept is still relatively new compared to other designs with considerable potential for the future.

SUMMARY

Although a third generation is emerging, new developments are still very active with the various double layer designs, particularly in connection with fine mesh double layers and strand configurations, to improve top surface fiber support and reduce fibre embedment. The aim is towards more efficient draining fabrics, better retention, less wire mark, good sheet release and less drag which in total should improve quality and performance.

The way to achieve these goals is by the careful selection of design and specification, utilizing today's technology and precise paper machine operating data.

EQUIPMENT DEVELOPMENT (PART II)

The past twenty-five years has seen table rolls replaced by a variety of foil designs from the high density polythene, tungsten carbide and KT insert mounted in same and a hard nosed high quality ceramic, as an integral part of the high density polythene foil. The models are designed with tee slots for flexibility and ease of removal, see Fig 19a, b, c & d. (see page No. 8)

The low vacuum chamber was an early development, from which a progression has resulted in a totally new generation of papermaking tools, such as Orthoflo, Duoflo and high vac units. During the past two years tha Isoflo concept has emerged as a "new tool", for the early part of the table, consequently total vaccum control for this equipment can now be considered by the papermaker.

The fourdrinier table layout of the future is illustrated in Fig. 20, from Forming Board to high vac units indicating the independent vacuum control.

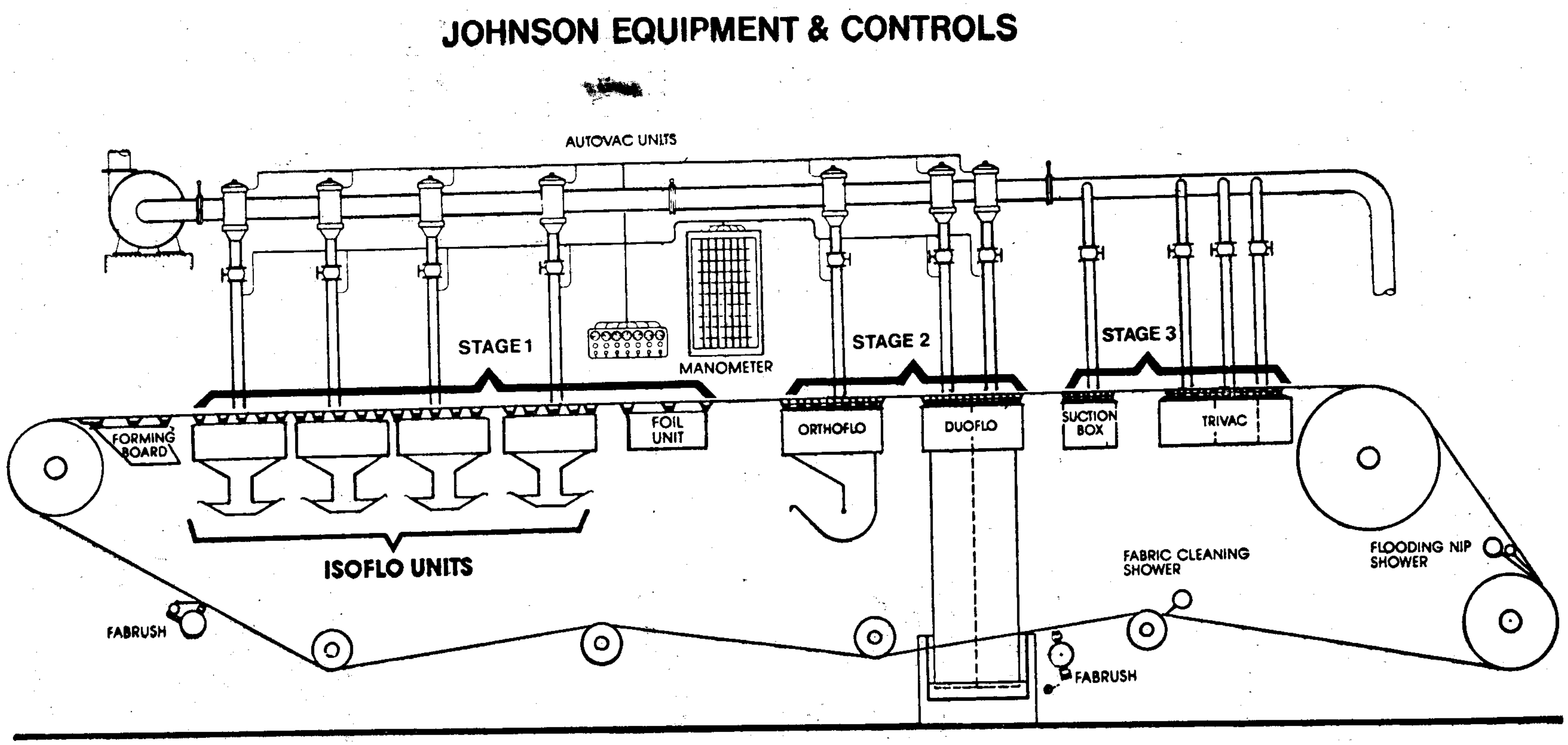


FIG 20. Model Fourdrinier indicating three stages of independently controlled dewatering.

The basis of these new developments has been to obtain maximum flexibily in terms of papermaking in the early part of the table, where the sheet is still fluid, with a gradual change moving into the dryer part, where optimization of water removal is desirable This optimization takes into account, power consumption in terms of vacuum required, as well as power consumed in the form of drag load measured at the couch and forward drive roll.

The modern approach of applying dewatering technology start with a full water management study of the table from head box to couch. This is carefully analysed and followed by clearly defined and agreed objectives, which allows detailed approach to controlled dewatering with built in flexibility. This may point towards a complete review of the whole table for maximum effect, utilising the latest technology and experience in equipment design. To re-equip completely in most cases would only cost a fraction of some of the alternatives. Specialized equipment for each stage of dewatering is necessary to achieve the optimum at various parts of the table, which is paramount if savings in energy, fibre loss and improvements in production and quality are to reach their potential.

FORMING BOARD

It is still considered a useful papermaking tool providing flexibility in the slice area, allowing the required jet trajectory to be aligned with the nose of the forming board. A modern design should be treated as a precision tool which with experience can still be applied effectively.

FOIL AREA

What we know as conventional foils, used to create activity and control the first stage of dewatering, is now beinge superseded by the Isoflo type of equipment (Ref : 8). This new technology consists of a support and control blade configuration, which is computer calculated. The assembly is mounted on an enclosed unit with a suitable discharge. The desired stock activity and drainage are achieved by adjusting the vacuum from an external source as shown in Fig. 20 which can ultimately be integrated into an existing wet end computerized system.

Fig. 21a shows the principle of the support and control blade. The precise pitching and step setting, between the blades on the unit and the correct spacing between individual units, allows a pulsating rhythm to be generated and create activity over the forming part of the table. This promotes improvements in formation to be made whilst preventing sheet sealing. The vacuum control provides the necessary downward force on the stock and fabric, to ensure that the step is maintained as well as removing the desired amount of water. The water removal can be graduated over the units involved.

High speed photographs illustrate various levels of activity from high acitivity on brown paper grades Fig. 21b, medium activity on fine paper grades Fig. 21c, down to low activity on bleached board grades Fig. 21 d. The Isoflo principle has now been successfully applied to most grades of paper and board.

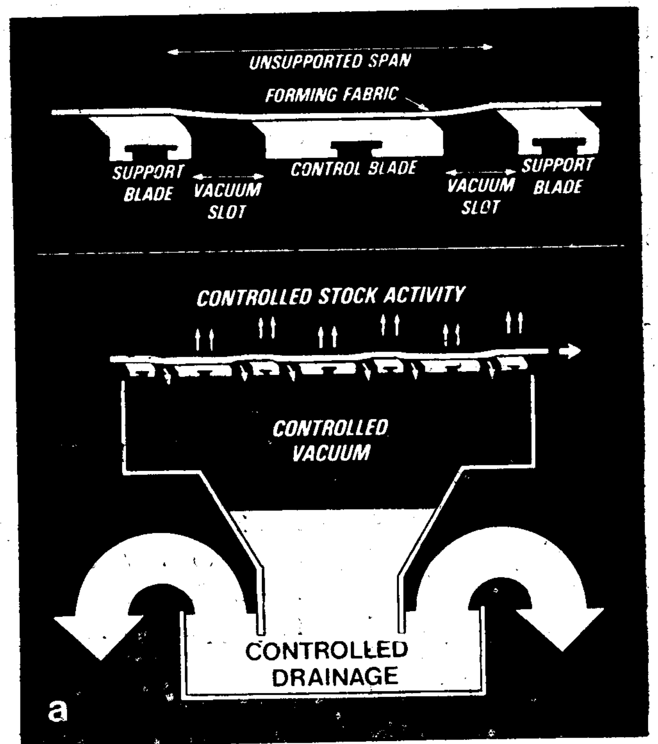
LOW VACUUM EQUIPMENT

In recent years considerable benefits have been achieved in this area or second stage of dewatering. The success has come from the correct analysis of water management, indicating immediately how much water is available on the table.

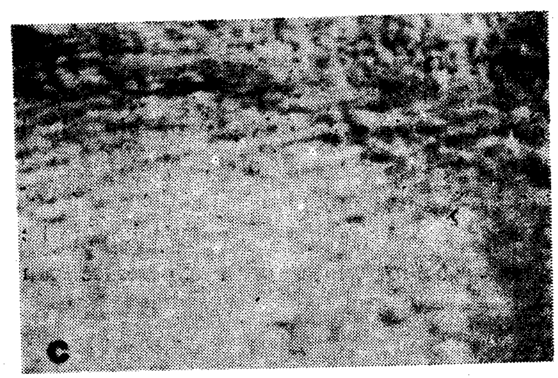
Individual low vacuum units can be designed to do a specific job. It is not just the units water handling capabilities which are calculated, but the distance required between the individual blades in contact with the fabric. This is also important when balanced against the vacuum levels intended to run in a particular unit.

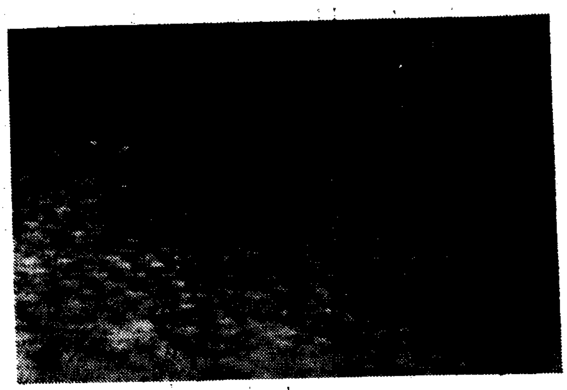
Fig. 22a illustrates the action over a low vacuum box whereby the pressure created by vacuum squeezes the stock and expedites the water into the chamber (Ref : 8). Correct blade spacing and vacuum levels in conjunction with appropriate box and discharge design, allows the maximum amount of water required to be removed at the minimum vacuum level.

Fig. 22b shows a typical three unit arrangement designed to cater for vacuum levels between 25mm and 1,100mm of H_2O. Note the increase in drop leg length to accommodate the increase in vacuum.



a) Isoflo support and control configuration (above) is computer calculated. Desired stock activity and drainage are achieved by altering the vacuum (below)



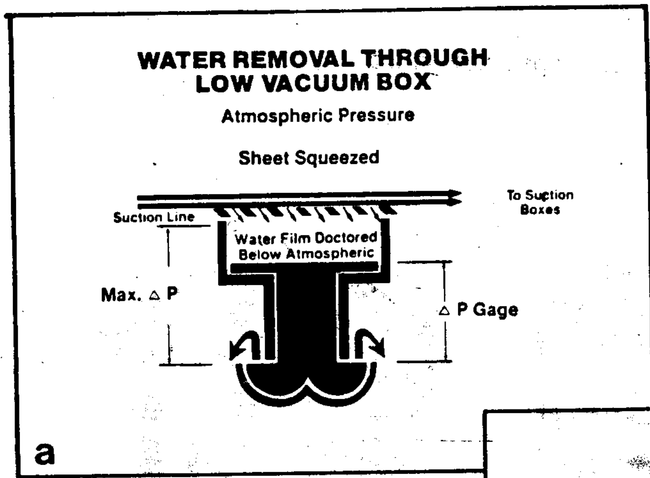


b) High activity on brown paper grades

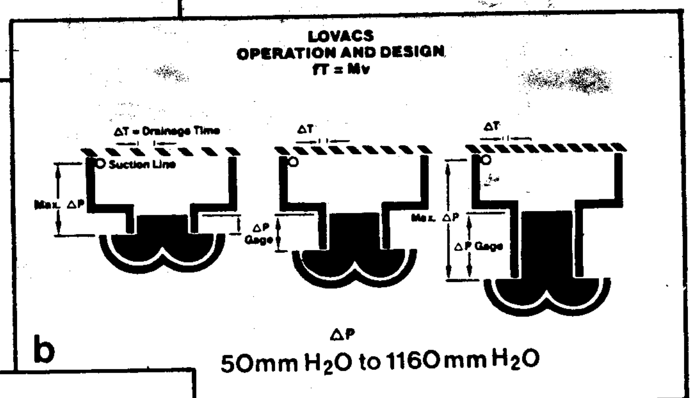
c) Medium activity on fine paper grades

d) Low activity on bleached board grades

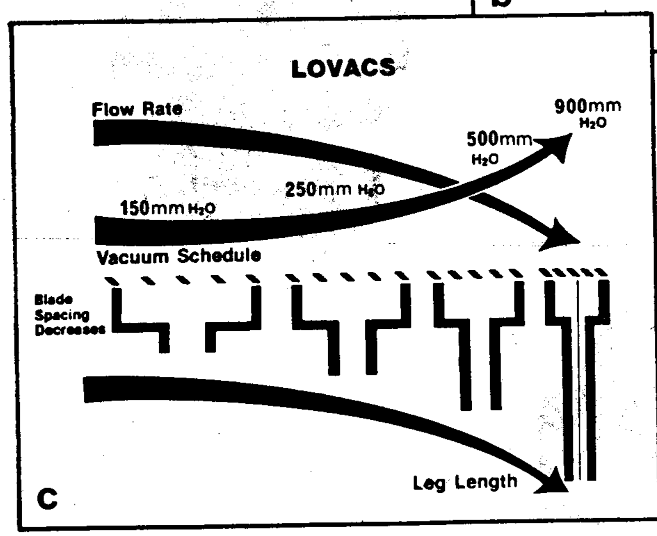
FIG 21. JOHNSON ISOFLO CONCEPT



a) Action over low vacuum box is balanced to remove maximum water with minimum vacuum



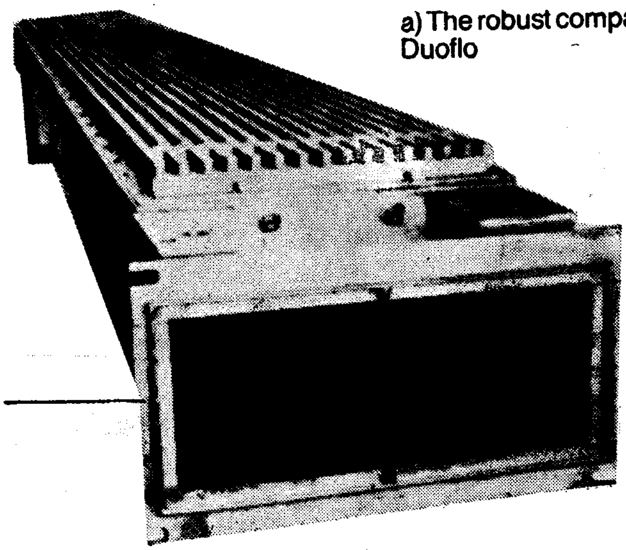
b) Typical three individual chamber layout designed for graduated vacuum



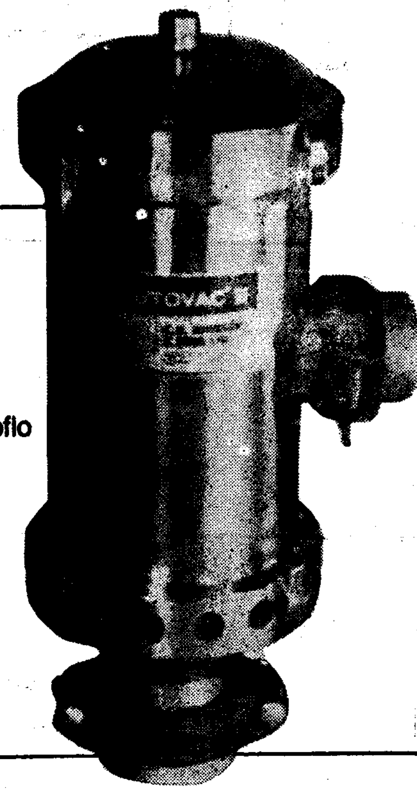
c) Principle objectives of controlled dewatering reduced blade spacings with increasing drop legs.

d) Low vacuum unit fitted with high quality ceramic tops.

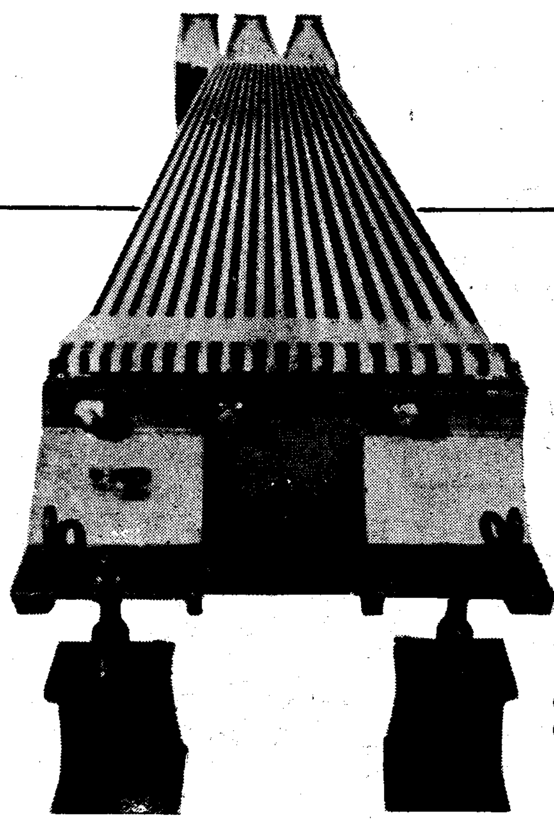
FIG 22. LOW VACUUM EQUIPMENT



a) The robust compact design of a Duoflo

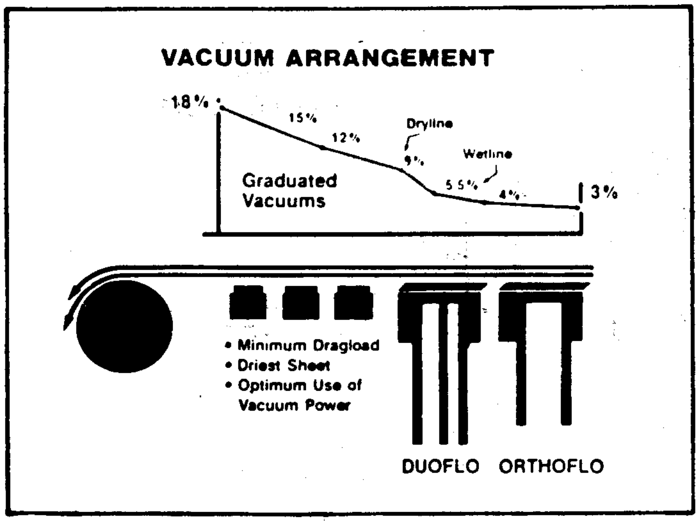


b) Autovac controller used with Isoflo and low vacuum units

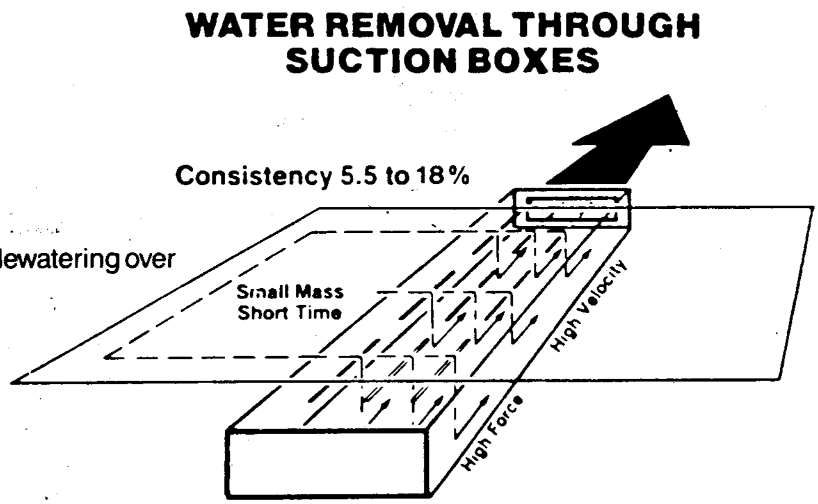


c) Triple chambered high vacuum box used to provide equal or better drainage in less space with reduced drag

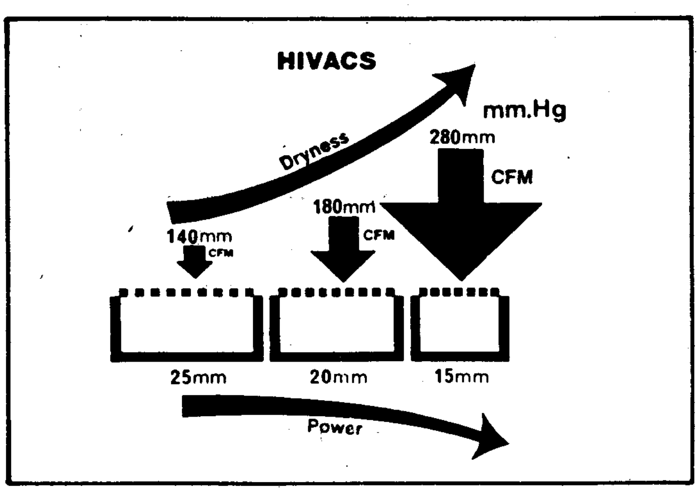
FIG 23.



a) The location of Duoflo unit—Note the capacity of Duoflo raising the consistency to 9%. By substituting single and double chambered low vacuum units, the number of conventional suction boxes can be reduced.



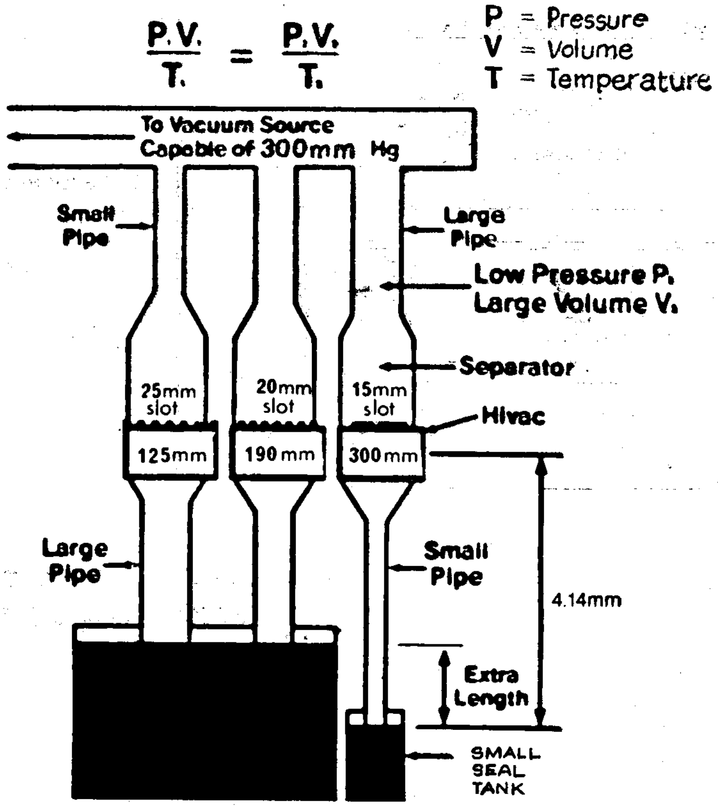
b) The principles of dewatering over the flat box



c) The concept for the efficient new high vac arrangement by reducing blade spacings and unit width and increasing vacuum.

FIG. 24.

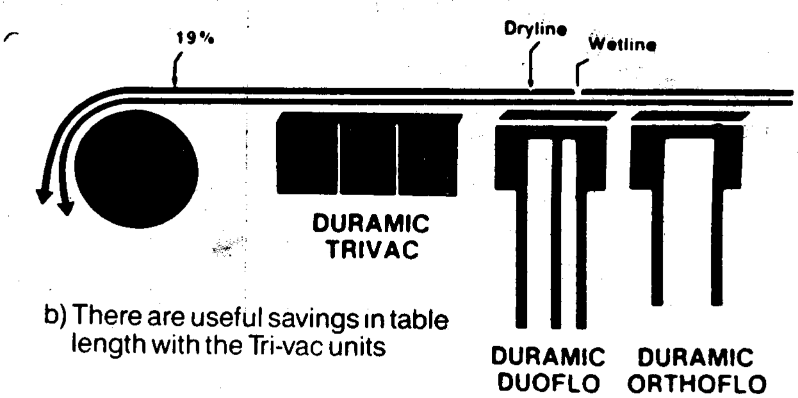
HIVAC SYSTEM



a) New vacuum system indicating graduated flow requirements for suction and discharge

COST EFFECTIVE PLANNING

- Maximum Space Recovery
- Optimum Vacuum Utilization
- Minimum Dragload
- Maximum Fabric Life
- Maximum Dryness
- Maximum Retention
- Minimum Maintenance



b) There are useful savings in table length with the Tri-vac units

FIG 25.

Fig. 22c shows a schematic of the principles applied over the low vacuum area, where decreasing blade spacings with increased vacuums, are matched by a gradual reduction in the flow rate of water. The units are designed reducing in width and discharge with longer drop legs. This configuration results in the minimum drag loads generated by fabrics passing over the stationary elements.

Fig. 22d shows a typical low vac box top fitted with ceramic blades.

DUOFLO UNITS

The idea is to have a unit or units capable of bridging the gap between the standard foils and/or Isoflo units and the high vacuum section as the latter part of the second stage of dewatering. Double chamber units can be utilised according to requirements. The twin unit has the capability of operating from zero to maximum, the level of which is determined by calculation and experience. In most cases the first section would operate around 500mm H_2O and the second up to 1,500mm H_2O on a typical newsprint machine. With freer draining sheets the vacuum levels in both chambers would be suitably reduced. In the case where a Dandy Roll is used, the second chambers will be set to control the moisture very accurately as the sheet passes into the Dandy area.

Fig. 24 a shows the positioning of these units and the chart indicates the amount of dewatering possible up to 9% contistency (Ref : 8). The installation of such units permits a re-assessment of the high vacuum section, resulting in a reduction in the number of flat boxes required.

Fig. 23a shows the robust compact design of the Duoflo unit.

AUTOVAC CONTROLLER

The outline of the controller is shown in Fig. 23b. This vacuum controller allows precise control to $\pm$12mm of H_2O in the very critical range of 0-250mm H_2O. The controller has an over all range of 0-1500 mm H_2O. These units are used as the control source for Isoflo and low vac units.

HIGH VACUUM AREA

The approach to the final stage of wet-end dewatering is similar to the low vacuum section, in so far as, full width slots as opposed to the traditional drilled pattern tops are used. Increased machine direction stiffness can be attained by multi-chamber assemblies as shown in Fig. 23 c which details a Tri-vac unit. Calculations are based on the theory outlined in Fig. 24b, in balancing time and mass, against force and velocity (Ref : 8). Using principles based on calculating the correct number of support blades and slot widths, maximum water removal is possible, whilst optimizing the use of existing vacuum pumps and minimizing the drag loads generated at the couch and forward drive roll.

Fig. 24c illustrates the design prinicples adopted in applying a Tri-vac by graduating the vacuum and water removal over the flat box area. This requires a very careful investigation of the machine, from which individual components can be designed to optimize the performance of each vacuum chamber, to ensure effective dewatering as the sheet approaches the couch.

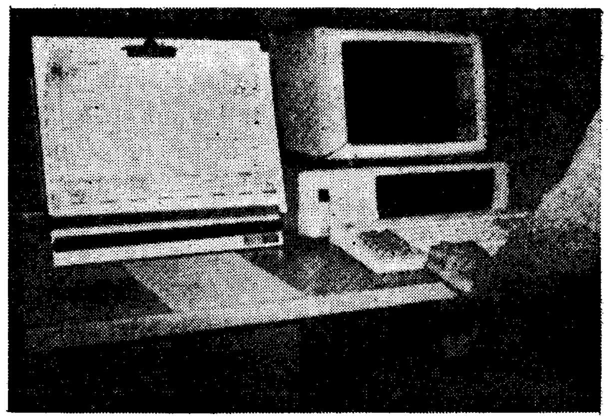
Fig. 25 a shows a schematic layout of a "new" high vac system, depicting flow and volumes of both air and water and the corresponding vacuum levels. Note the sizing of air flow pipes and drop legs.

Fig. 25 b lists the main advantages with this new technology when the modern concept of Orthoflo/Duoflo and specially designed high vacuum boxes are used.

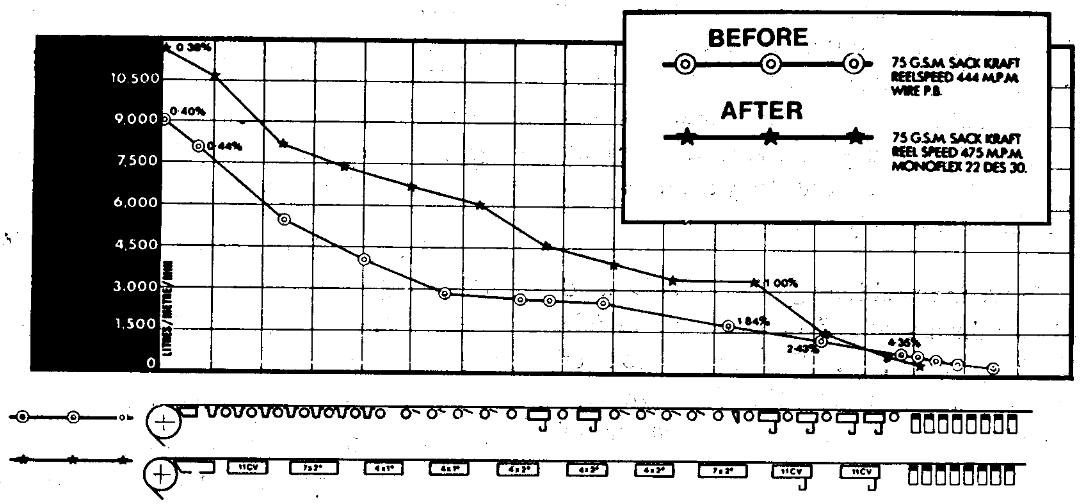
Quite often 50% of the drag load (power) is generated over the suction box area, therefore large savings in energy can be made in this part alone.

WATER MANAGEMENT

Machine details and stock samples taken at various points on the machine, from headbox to couch, are computer analysed as part of the water management survey (See Fig. 26 a). The computed results of the study are then presented in the form of a graph, where the actual consistencies will be plotted alongside existing equipment. The proposed changes in location and design of equipment are outlined below (see Fig. 26b) of a tppical water management study chart.

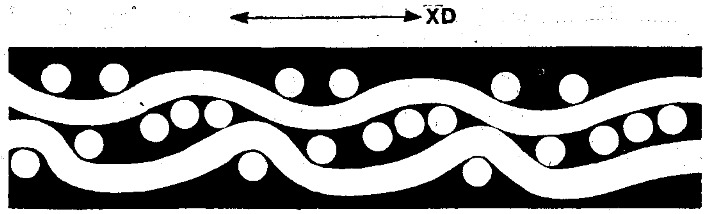


a) The information obtained from various parts of the wet-end are computer analysed

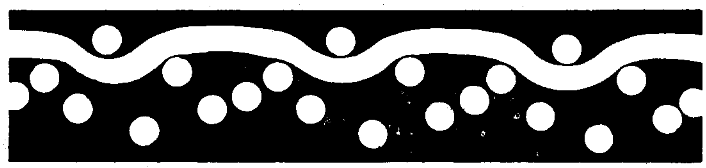


b) The final results of the water management study presented in graph form, indicating consistencies set against the existing equipment detailed below The chart also shows the actual curve from a water management study taken after the table had been modified (new equipment layout below) indicating a 10% decrease in head-box consistency.

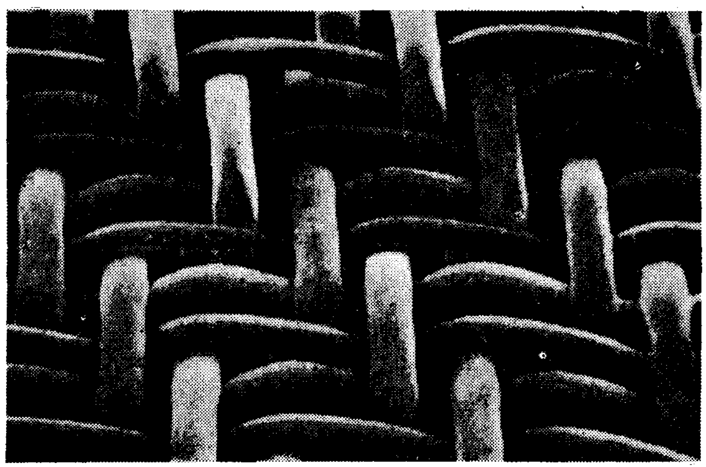
FIG 26.



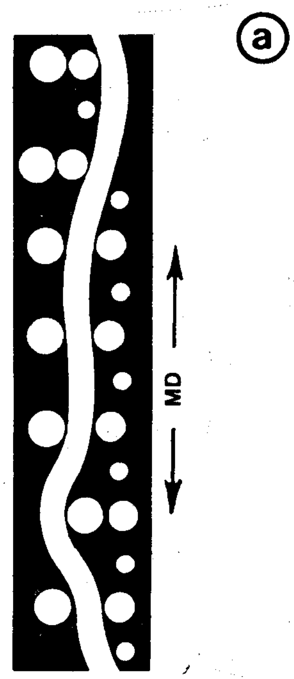
Cross-section showing normal paper side and machine side XD strand profile

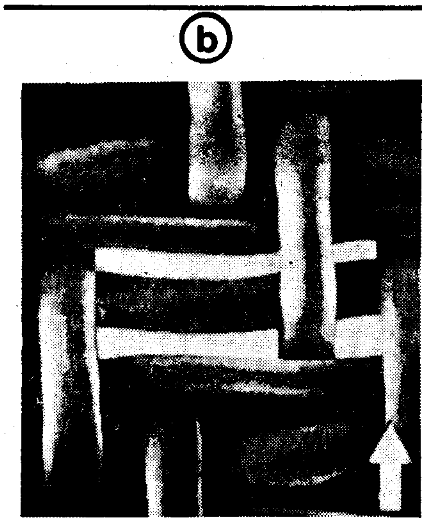


Cross-section showing paper side JDL XD strand profile

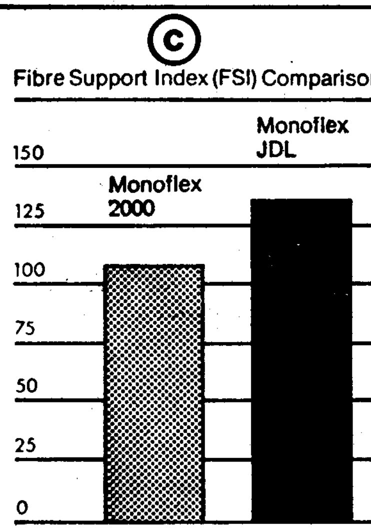


FABRIC PAPER SIDE

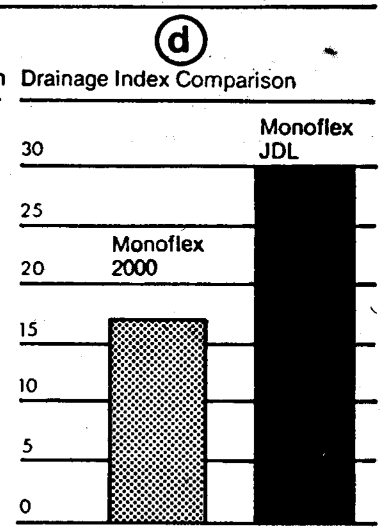




Top surface (sheet side) has very short, regular, machine direction frames



The higher FSI values of JDL improve sheet release and reduce wire mark resulting in efficient machine operation and superior sheet quality



Because of increased fibre support and reduced fibre embedment, JDL's drainage index is superior to that of standard double layer fabrics

FIG 27 MONOFLEX JDL DETAILS

Note that the dewatering profile, after the table modifications has been added, resulted in a 10% decrease in head box consistency.

For a full assessment of the table and its potential water management techniques are essential—

Good	Higher	Better	Energy
Water Management =	Production +	Paper Quality +	Savings

SUMMARY

The high quality aluminium oxide (ceramic) segmented foil blades and box tops, are accurately assembled on robust units, to accommodate the anticipated stock loads and vacuum forces. Such units are capable of withstanding environmental changes, such as known vibration frequencies, and provide the basis for the application of the new dewatering technology.

The technology now available points the way tnto the next decade and possibly into the next century, with precision equipment which can be accurately controlled and monitored by a computerized system. This forward approach with the built-in flexibility will allow the production and quality to be monitored over the full table.

CONCLUSION

When we combined today's technology and experience with fabric specification, their overall machine performance, the control over the generation of activity and dewatering levels for all grades under known machine conditions, the potential for savings in capital costs, space and energy are considerable. Fine tuning between fabric specification and dewatering equipment can be important and allows further scope for improvement in wet-end performance.

This modern technology could not have been applied without product improvement, based on the selection of materials, quality of manufacture, using modern techniques and attention to detail. Both fabrics and equipment are high class precision products. They should never be considered as simply commodities, but papermaking tools of the highest order. Water management techniques form the basis of all the development discussed and the expertise is available to all.

ACKNOWLEDGEMENT

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