Waste Paper Processing System

A. AHLSTROM OSAKEYHTIO

INTRODUCTION

Fibreflow is a development by A. Ahlstrom Osakeyhtio for waste paper processing. This paper purposes to outline the essential features of the system and the factors affecting the overall stock preparation process in various applications.

The paper concludes with some consumption data and a brief account of the units in operation today and how these are applied in the process.

The R & D work on Fibreflow continues to add to our know-how correspondingly. Thus, for any additional data on the Fibreflow technology or for a quotation, please contact the Karhula Engineering Works of our company.

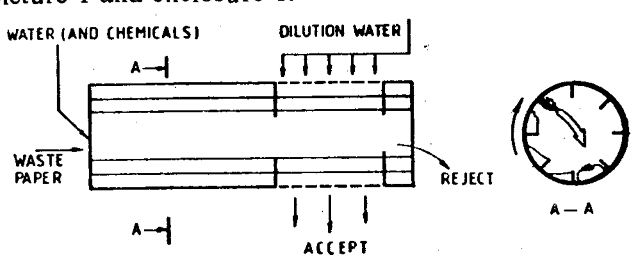
FIBREFLOW SYSTEM

Principle and main features

The operation is based on a simple physical principle :

Waste paper is wetted to about 15% consis tency and is then successively dropped on a hard surface. A very high defiberization degree is reached at only about 1 m dropping distance by repeating the operation 200 times or so.

In practice the defibering takes place in a rotation drum, which also operates as a screen. For the purpose of this prescreening, part of the drum shell is perforated. The principle is illustrated by picture 1 and enclosure 1.



The drum can be preceded by a bale breaker for crushing the bales and there by transforming the paper into a form suitable to be fed to the drum. Of course if loose waste paper is available, the bale breaker is superfluous.

A belt conveyor feeds the paper from the bale breaker to the Fibreflow drum. The first part of the drum is not perforated, and in this zone the paper is wetted and treated long enough to become fiberized. The consistency in the zone is kept at about 15 per cent. A slight inclination of the drum makes the material move forward to the screening zone of the drum, whieh is perforated (small holes of 4 to 10 mm). The material is diluted to a low consistency, and the fibre material is washed out through the perforations. All reject material too strong to disintegrate in the defiberizing process and too large to get through the perforations is rejected.

The accepted pulp drops down to a bottom vat. Generally, the degree of defiberization is very high at this stage already, Note that no cutting operation is used during the defibering process. This way the fibre length is kept up better than in conventional processes.

The defiberizing effect achieved with Fibreflow is very good. By measuring the effect as a function of retention time and the amount of paper flakes of the accepted fibre, whereby a screen wire with 2 mm width is employed, it is noted that the number of flakes after 15-20 minutes is very small. Thus, the further screening can be simplified. Enclosures 2 and 3.

The drum is designed for a retention time of about 15 to 20 minutes in the first zone. Put into practice and taking Into account the adjacent drum section, the screening zone, this means that :

— plastic-coated and other badly contaminated papers can be utilized as raw material.
— at high consistencies, chemicals consumption is lower in deinking processes.
— power consumption is lower, being 15-25 kwh/ton of defibered pulp,

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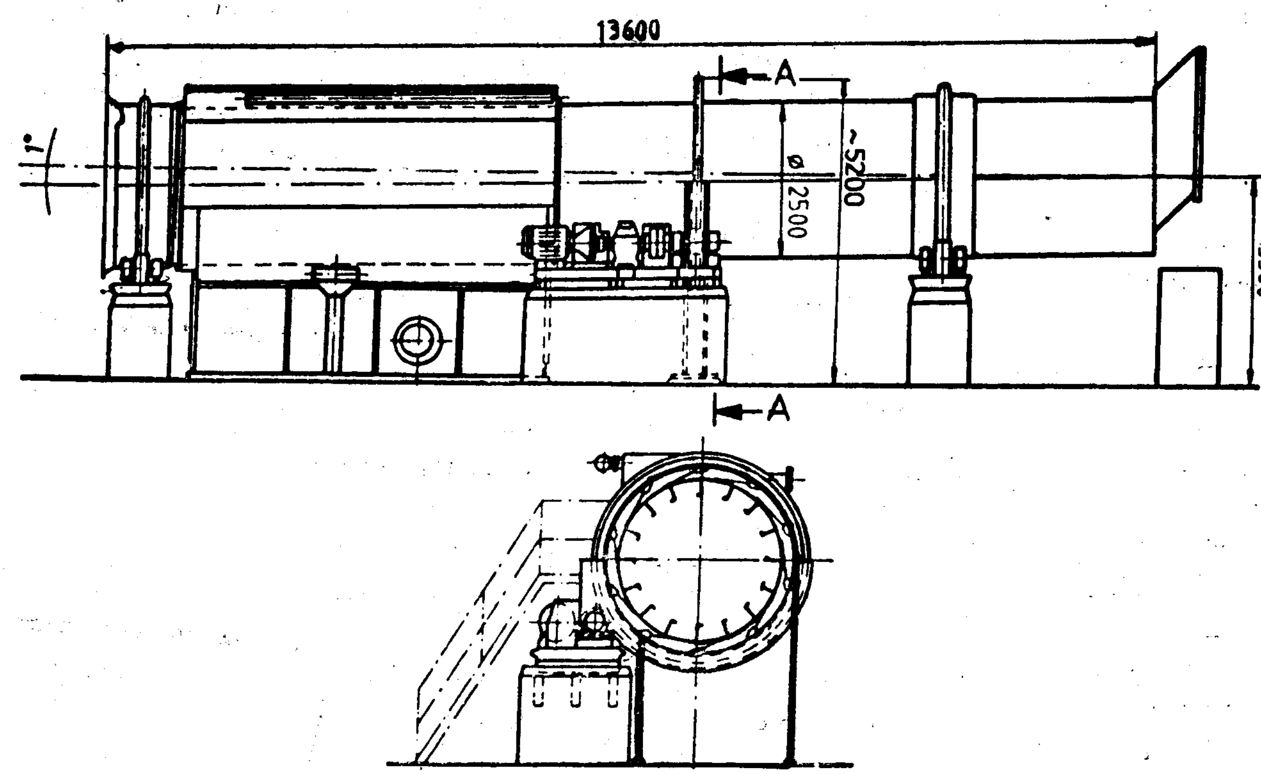

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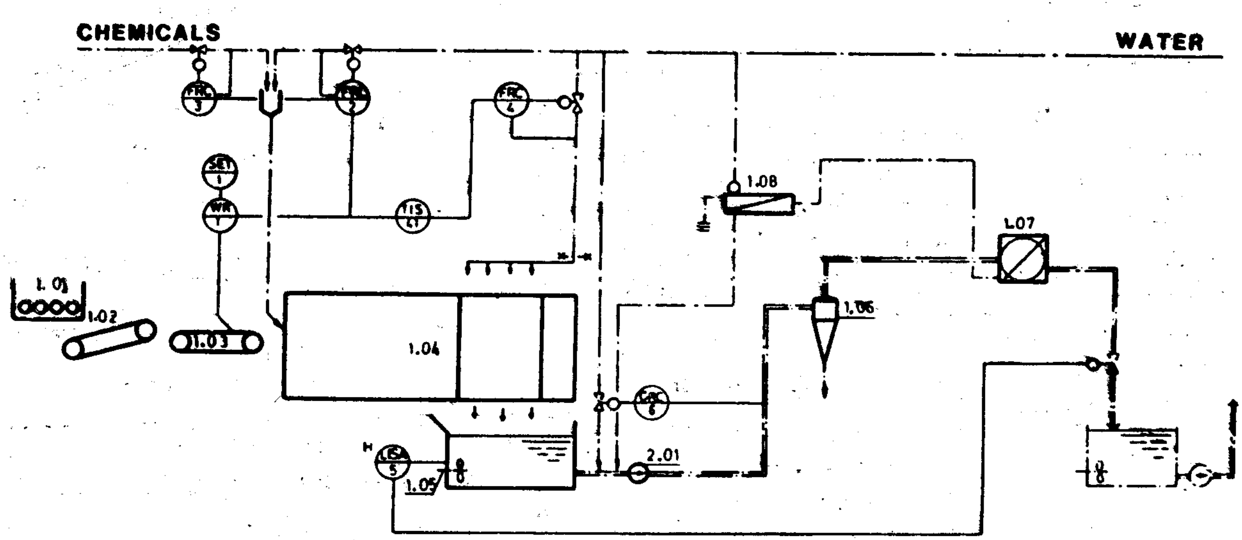


1.01 BALE BREAKER (OPTIONAL)
1.02 FEEDING CONVEYOR
1.03 SCALES CONVEYOR
1.04 FIBREFLOW-DRUM
1.05 PROPELLER AGITATOR
1.06 HC-CLEANER
1.07 CENTRISORTER
1.08 TR-VIBRATING SCREEN

Additional basic features include lower investment costs for the stock preparation machinery after the Fibreflow, Moreover, less manpower is needed with an automatic system.

All the parts of the drum itself are stationary. This means low service costs. The Fibreflow unit with the longest continuous run has been in operation for over four years. The original screen plates are still in use and there's still no need for replacement.

Dimensions and design

Drum size varies greatly, and depends on output. Capacities vary between 15 TPD when the diameter ranges between 1.7 m and 3.25 m and the length between 6.0 and 20 m respectively. The mechanical design also varies; smaller drums may have a hydraulic drive with rubber-covered drive rolls and larger ones a mechanical drive.

The internal parts of the drum itself comprise the lifters and a longitudinal flow contral system with a special design that ensures an adequate defiberizing rate and even dosing in the screening zone.

The screening zone of the Fibreflow drum is covered with a hood to prevent the stock from splashing. The hood is also provided with an inlet box coupled to pipes for supplying dilution water to the screening zone.

WASTE PAPER PROCESSES AND FIBREFLOW

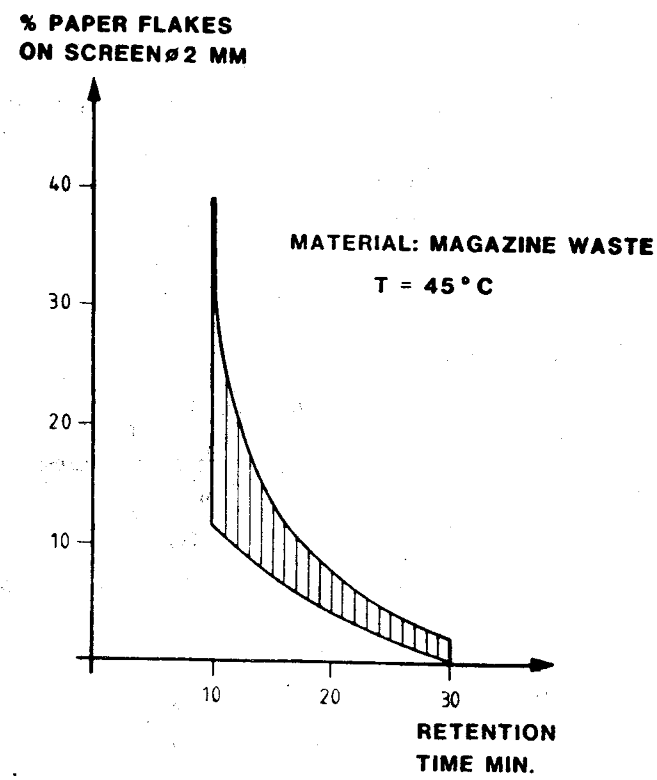
Conventional processes

This paper illustrates the suitability of Fibreflow for various waste paper processes by means of three diagrams (encs 4, 5, 6,) one of them showing the screening system for mixed waste, and the other incorporating deinking as well. Naturally, each of the two processes calls for different kind of screening, thickening, refining, and other operations, all of them to be determined case by case.

Extensive trials with materials collected from many different countries show that Fibreflow is extremely well suited for the starting point in both processes. In principle, the same drum can be used for different materials; when making comparisons as to waste paper defibering effect in the drum, output is used as the variable. Obviously, with easier-to-defiber materials, the capacity is higher, whereas it is lower with materials of higher reject content.

Processes that follow Fibreflow can, as a rule, be simplified. In typical solutions, the defibering result achieved in the Fibreflow drum suffices. The pulp is pumped from the bottom vat via a sand trap to a pressure screen. In the main line, no individual deflaking process is needed for reject material, since a high enough defiberizing effect is reached by installing a reject deflaker in the pressure screen reject line. Even the deflaker can be passed by, subject to favourable circumstances, and the vibrating screen alone is then adequate (encl. I).

INFLUENCE OF RETENTION TIME ON THE AMOUNT OF PAPER FLAKES IN THE PULP WITH DEINKING

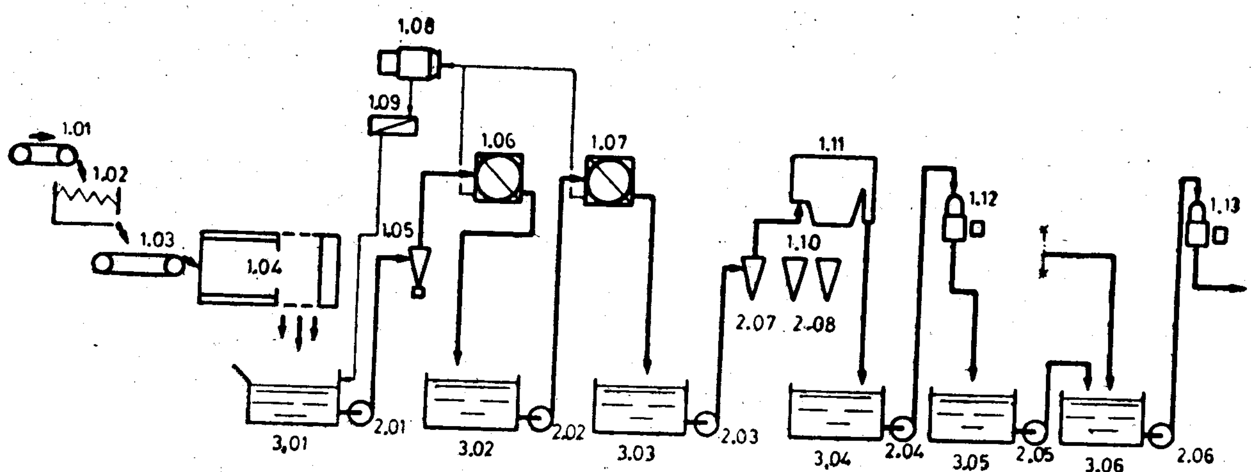


THE FIGURE IS SUMMARY OF A SERIES OF TESTS

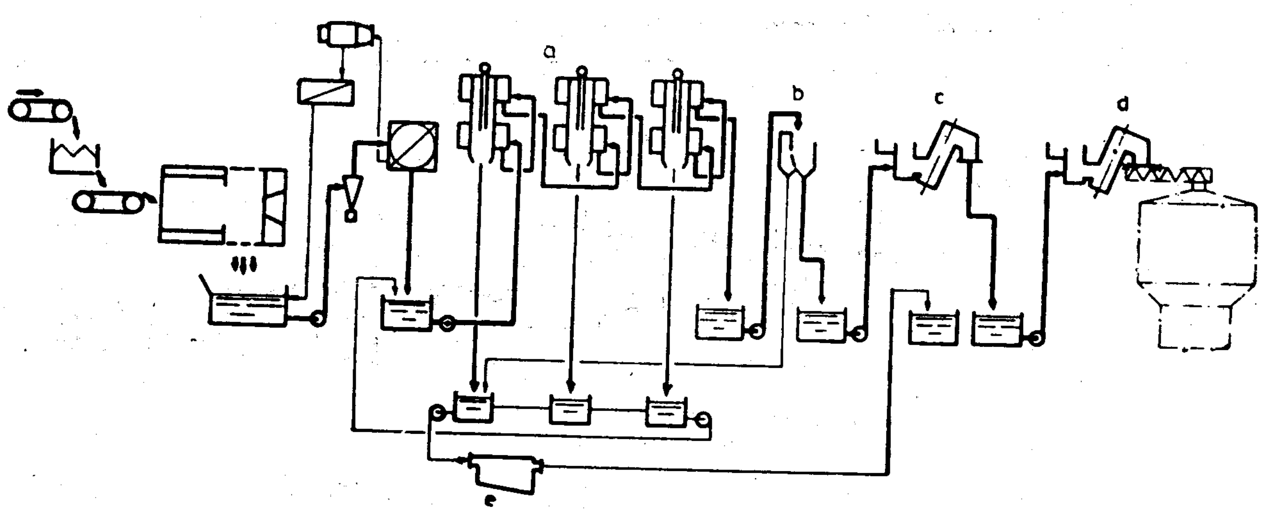
After the pressure screen, the accept pulp is led on in the process, as usual.

In the following, two alternative flow sheets are presented as examples of stock preparation.

In the first process (enc. 4), the first stage pressure screen is followed by a second stage one. The cleanness grade of the pulp is heightened by utilizing screens, e. g. Bird Centrisorter with both



1.01 BALE CONVEYOR
1.02 BALE BREAKER
1.03 SCALES CONVEYOR
1.04 FIBREFLOW DRUM
1.05 HC-CLEANER
1.06 I STAGE PRESSURE SCREEN
1.07 II STAGE PRESSURE SCREEN
1.08 DEFLAKER
1.09 VIBRATION SCREEN
1.10 3-STAGE CENTRIFUGAL SCREENING
1.11 THICKENER
1.12 REFINER
1.13 TRIM REFINER
2.01-2.08 PUMPS
3.01-3.06 VATS AND TANKS



a) 3-STAGE 6-CEU DEINKING
b) BOW SCREEN
c) SCREW THICKENER
d) SCREW THICKENER
e) EFFLUENT TREATMENT

perforated and slotted screen drums. The accept pulp is pumped on to a three-stage centricleaning plant and the reject material is treated on a vibrating screen and, if necessary, in a reject deflaker. The thickener after centricleaning is followed by refining. Prior to paper machine, the pulp still undergoes trim refining.

The second process is illustrated by a flow sheet showing deinking as well (enc. 5).x) The line is purposed for tissue production. The paper defibering process is followed by 3-stage and 6-cell deinking flotation installation. After flotation the stock is washed on bow screens and, e. g, in screws thickeners. Facilities for separate bleaching can be installed between the washing stages. The process such as it is shown on the diagram also requires separate effluents treatment.

Municipal waste as raw material source

Municipal waste consititutes an increasingly interesting source of waste paper for the paper industry.

Systems are being developed by several mills to separate the paper fraction from municipal waste. The material is naturally mixed with many paper-like contaminants, such as plastic, cloth etc. which are difficult to sort out by conventional methods.

The adaptability of Fibreflow for processing this kind of material has been put to trial with both our laboratory drum and our pilot plant producing about 20 tpd. The results achieved are considered good. From the paper technical point of view, quality of the pulp achieved by utilizing the Fibreflow system is fully acceptable for producing certain grades, such as middle layer of multilayer boards. Naturally, such materials require a more thorough follow-up screening after defibering.

In this specific field, too, progress is being made in R & D. Among the many aspects to be taken into account are those of hygiene.

CONSUMPTION DATA

Chemical consumption

In a deinking process, the price of chemicals makes up a large part of the total costs. The physical operating principle of Fibreflow, *defiberization at about 15% consistency,* is convenient as most deinking-chemicals can be added to the drum together with the dilution water.

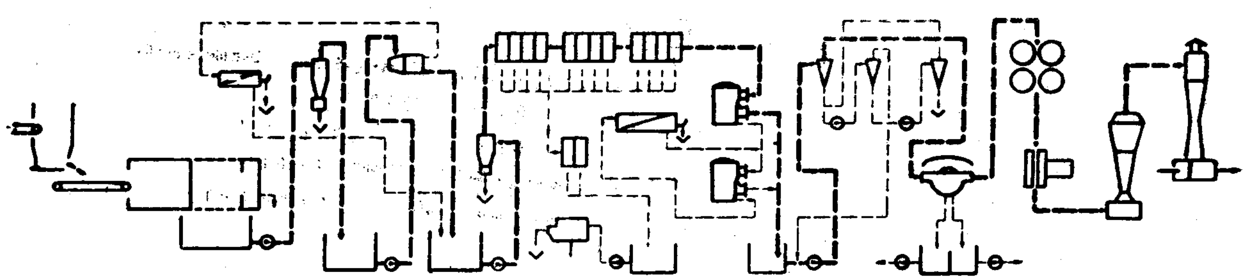
Chemical compositions applied to deinking vary considerably depending on conditions at the mill. The following list gives the chemicals most commonly used for deinking :

1. Sodium hydroxide, fed direct into the Fibreflow-drum

PROCESS WITH DEINKING

FLOWSHEEST 2

KERÄYSKUITU MILL



1. FIBREFLOW DRUM
2. HC-CLEANER
3. CENTRIFINER
4. VIBRATING SCREEN
5. BALE BREAKER
6. LOW CONSISTENCY CLEANER
7. OUTOKUMPU DEINKING CELLS 3-STAGE - 12-CELL SYSTEM
8. OUTOKUMPU DEINKING SECONDARY CELLS
9. PRESSURE SCREEN
10. PRESSURE SCREEN FOR REJECT
11. VIBRATING SCREEN
12. CENTRIFUGAL CLEANING
13. DISC FILTER
14. ROLL PRESS
15. FLASH DRYING
16. BALE PRESS AND BALING LINE

x) For supplying deinking systems, Ahlstrom coope rates with other companies.

2. Protective colloid, e.g. sodium silicate, fed direct into the Fibreflow-drum.

3. Hydrogen peroxide, fed direct into the Fibreflow-drum.

4 Fatty acid, can be fed direct into the Fibreflow-drum.

5. Flotation chemical : some derivative of ethylene oxide.

6. Some chemical preventing decomposition of hydrogen peroxide such as ethylene diamine tetra-acetic acid (EDTA), can be fed direct into the Fibreflow-drum.

7, Calcium chlorine, if necessary, for hardness regulation.

Thanks to high consistency and vigorous mixing motion, considerable *savings are gained in the cost of chemicals* (Encl. No. 7). On the mill scale, a 10% saving has so far been gained, but theoretically, this is merely a rough estimate for the future.

Essential to the Fibreflow-method is quick wetting of the paper, which is necessary for reaching a high enough degree of defiberization. Owing to the chemicals used the stock pH is alkaline (9-10) in the fibreflow-process, which creates favourable conditions for defibrization. This does not apply to processes with no deinking.

Ordinary waste paper qualities can be defiberized by raising the temperature of dilution water. Yet, with thicker paper and cardboard grades sized with rosin and alum, wetting has to be speeded up by some alkaline chemical. such a sodium hydroxide.

> Paper is usually sized with rosin and alum to make it hydrophobic, i.e. prevent water from penetrating and transudating the paper. This is important for the liner and fluting in corrugated board, so they are very hard-sized-particularly liner. Normal rosin sizing does not prevent transudation but slows it down. The degree of sizing of paper is usually measured by the Cobb method, which determines the quality of water absorbed in g/m² of paper during a given period, 1 or 2 min. The quantity of water absorbed depends on the time and is roughly a function of the square root of the time. A typical hard-sized liner has a Cobb value of 15 to 20. This requires a transudation time of 60 to 70 min for a 120 g/m² liner, The transudation time drops rapidly as the pH value rises, i.e., in an alkaline environment. In 120 g/m² liner, for example, it decreases to 1-2 min at pH 11, and to 10 sec at pH 12.

Our R & D work is being continued also in this field. We have as a reference a Fibreflow pilot plant drum at the Fridafors mill of the Swedish Sodra Skogsagarna AB. The raw material they use is 100% polyethlene-coated waste paper for the fiberization of which only water with 70-80°C temperature is used.

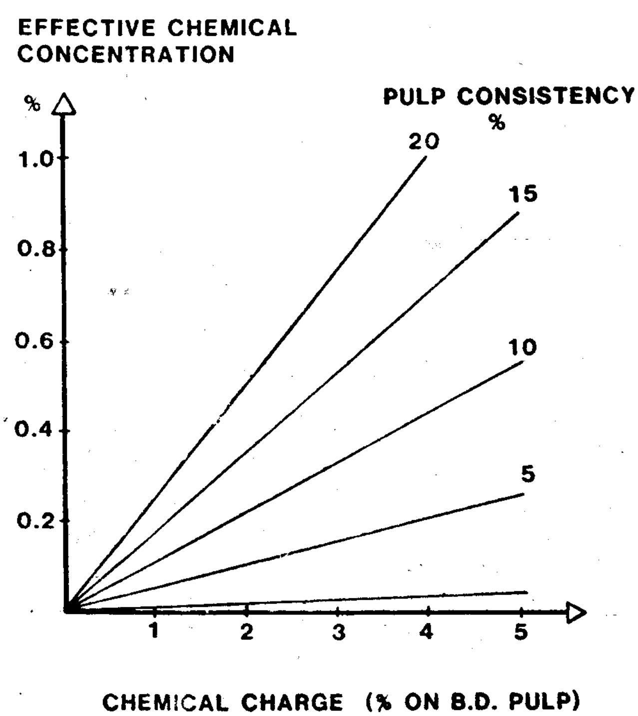
Water consumption

In the unperforated section of the drum the stock is first diluted to about 15% consistency. It then enters the perforated section where it reaches a dilution degree of 3 to 4%. This results in the dilution water consumption of about 30 m³/ton of defibered pulp.

Circulation water from a paper machine, deinking, thickening, etc. can be used as dilution water.

Power consumption

As to its electricity consumption, the Fibreflow-drum is very economical : the power needed *is only about 15 to 25 KWh/ton* of pulp. This is due to high consistency of the pulp and to the principle itself; no cutting forces are applied. Encl. 8.



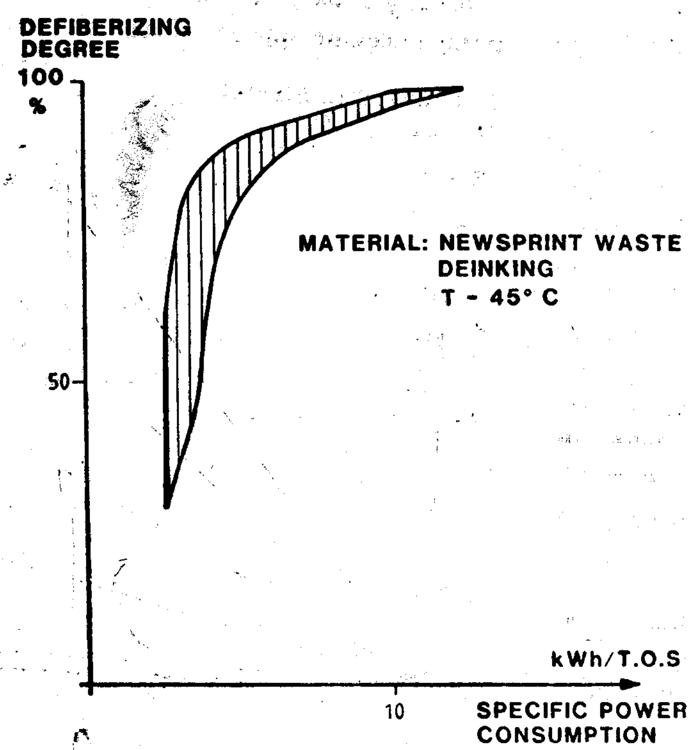
In certain types of processes energy is needed for heating the dilution water. In the deinking process, 20 to 45°C, is sufficient, in other processes the temperature is higher depending on whether or not chemicals are used for raising the pH value.

In consumption calculations the whole process has to be taken into consideration : the Fibreflow-method cuts down the total energy consumption, partly because of a simpler screening system.

APPLICATIONS

Today hundreds of thousands of tons of waste paper are treated yearly in various parts of the world with Fibreflow. Encl, 9.

SPECIFIC POWER CONSUMPTION



THE FIGURE IS A SUMMARY OF SERIES OF TESTS

The production of paper grades which have Fibreflow applications, includes e.g.

- newsprint
- tissue
- multilayer boards
- deinked market pulp based on 100% waste paper

The waste paper grades that are used, include e.g. old newspapers and magazines, household collected and mixed waste paper, even polyethylene and aluminium coated grades.

INTERNATIONAL COOPERATION AND R & D

In 1979 A. Ahlstrom Osakeyhtio made a licence agreement with the Japanese C. Itoh, According to the agreement C. Itoh, together with Ebara Corporation, will manufacture and market the Fibreflow method in Japan and some other Far-Eastern countries.

As a result of this cooperation the first two Fibreflow units, both with the nominal capacity of 300 tpd, the biggest so far, have been delivered and started their operation.

The Fibreflow drum naturally comprises only a part of stock preparation systems of various kinds, which include further, necessary unit operalions.

Ahlstrom is already prepared, if needed, to deliver in co-operation with other suppliers complete systems, including screens, thickeners, tanks, vats, pumps, instrumention etc.. according to the special requirements of the customers.

The research and development continues as well; the R & D centre, Hans Ahlstrom Laboratory, has very interesting projects to be studied in detail in the field of waste paper processing.

ENCLOSURES

1. Fibreflow 250 drum.
2. Fibreflow system.
3. Influence of retention time on the amount of [illegible] flakes.
4. Process flow sheet.
5. Process with deinking flow sheet 1
6. Process with deinking flow sheet 2.
7. Chemical concentration as function of pulp consistency.
8. Special power consumption.
9. References.

A. AHLSTROM CORPORATION

REFERENCE LIST

FIBREFLOW DRUMS

Customer	Capacity	Application	Ordered
Fiskeby AB, Katrinefors Mill, Sweden	60 t/d	Deinking for tissue	1976
Kerayskuitu Oy, Sunila, Finland	200 t/d	Deinking for market pulp	1977
Fiskeby AB, Katrinefors Mill, Sweden	60 t/d	Deinking for tissue	1978
Reed Paper & Board (UK) Ltd. Imperial Paper Mill, United Kingdom	200 t/d	Deinking for newsprint	1978
Enso—Gutzeit Oy, Pankakoski Mills, Finland	100 t/d	Non-deinking for chipboard	1978
Sodra Skogsagarna AB, Fridafors Mill, Sweden	20 t/d	Non-deinking for board	1979
Oji Seishi K. K. Tomakomai Mill, Japan	300 t/d	Deinking for newsprint	1980 *
Cartiera Valle Marecchia Italy	55 t/d	Non-deinking for packaging papers	1980
Bunzl & Biach AG, Ortmann Mill, Austria	200 t/d	Deinking for tissue	1981
Stora Kopparbergs Bergslags AB Kvarnsveden Mill, Sweden	120 t/d	Deinking for newsprint	1981
N. Z. Forest Products Ltd. Penrose Mill, New Zealand	30 t/d	Non-Deinking for moulded products	1981
Daishowa Paper Co. Fuji Mill, Japan	300 t/d	Deinking for newsprint	1981 *
A/S Genfiber Assens, Denmark	110 t/d	Deinking for market pulp	1981

Customer	Capacity	Application	Ordered
Ahlstrom Machinery Inc. Glens Falls, N. Y., USA (to an American buyer)	170 short t/d	Deinking for tissue	1981
Nihon Kakooshi Co. Ltd., Japan	150 t/d	Deinking for fine papers	1981 *
State Research Centre of Finland Jyvaskyla, Finland	Pilot unit	Non-deinking	1983
Gebr. Lang AG Ettringen, Wes Germany (rebuild of the Reed drum)	200 t/d	Deinking for newsprint	1984
Oji Seishi K. K. Kasugai Mill, Japan	300 t/d		1984*
Ahlstrom Machinery Inc. Glens Falls, N. Y., USA (to an American buyer)	300 t/d	Repulping for tissue	1985

* delivered by C. Itoh and Ebara Corp., the Japanese licensees of the Fibreflow method