New Developments In Refiner Design

Bhattacharjee S.C. and Seksaria Sameer

INTRODUCTION

Fibre refining has always been an important phenomenon in paper making. Apart from improving fibre properties, it has the greatest influence on product quality.

Over the years, our collaborators M/s. Voith Sulzer, Germany has been continuously improving design of double disc refiners. The Twinflo-D Refiner is a recent development in this direction which combines the advantages of less moving parts, high efficiency and ease of maintenance.

TWINFLO REFINER-D

The main advantage of Twinflo-D is its complete welded design. Stock inlet is through a single branch and the refining gap is adjusted by electro-mechanical system.

The central rotor is hydraulically self-balanced between the pair of stators. The rotor runs on the shaft splines.

The Twinflo-D has been flexibly designed to accommodate fillings of erstwhile Voith and Sulzer Escherwyss design. A unique advantage with the rotor is that it can allow a radial overhang upto 3 inches of fillings. In other words, each size of Twinflo-D can accommodate a wide range of fillings diameter. This provides greater flexibility of refining.

Due to reduction in moving parts and welded construction, the ratio of no load power to installed power is extremely favourable. The Twinflo Refiner covers power capacity range from 300 kW to 3 MW and production capacity ranging from 20 to 1200 TPD.

To summarise, some of the salient features of Twinflo-D refiner are:

- High machine efficiency due to favourable ratio of no-load power to effective power.
- Rigid welded structures of cantilever-type construction for working pressures upto 7 bar.
- Highly efficient treatment adapted to the fibrous stock due to a range of optimized fillings in various materials.
- Maintenance-friendly due to small number of moving parts and easy accessibility.
- Fully enclosed in a clean and modern designed casing.

VOITH SULZER LABORATORY REFINER

As earlier explained, the fillings play a decisive role in ensuring a consistent fibre quality in stock preparation. The papermaker should therefore know the correct design of fillings and specific energy requirement to be imparted to fibres before starting production on the paper machine.

To achieve these results, Voith Sulzer has developed a Laboratory Refiner model LR1 to carry out such trials and optimise refiner installations and furnish mix. The refining process is simulated under laboratory conditions and conclusions are drawn for refining behaviour of the furnish.

The main refining parameters of refining are:

Specific Refining Energy : W_{spec} (kWh/t)

It is refining energy transferred to the fibres during refining process. Higher the specific refining energy, more intensive is the refining process.

Pulp & Paper Division
Larsen & Toubro Limited.
1B, Park Plaza, 71 Park Street
CALCUTTA-700 016

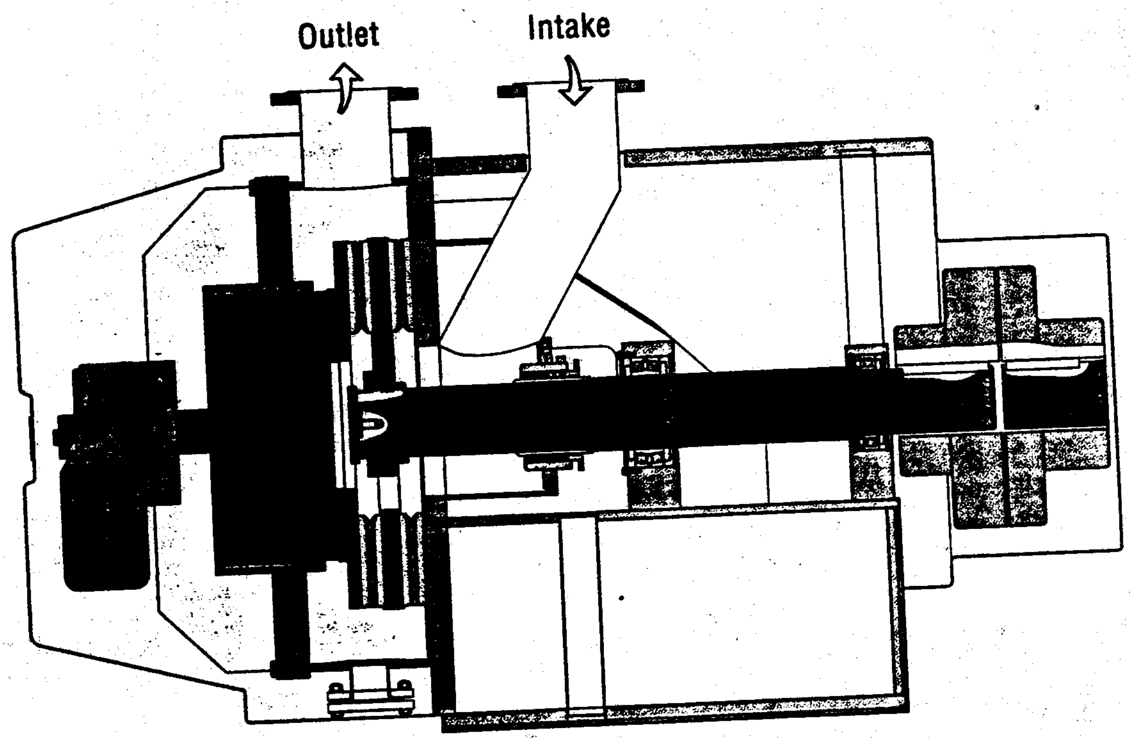

Fig. 1 : Refiner Twinflo-D

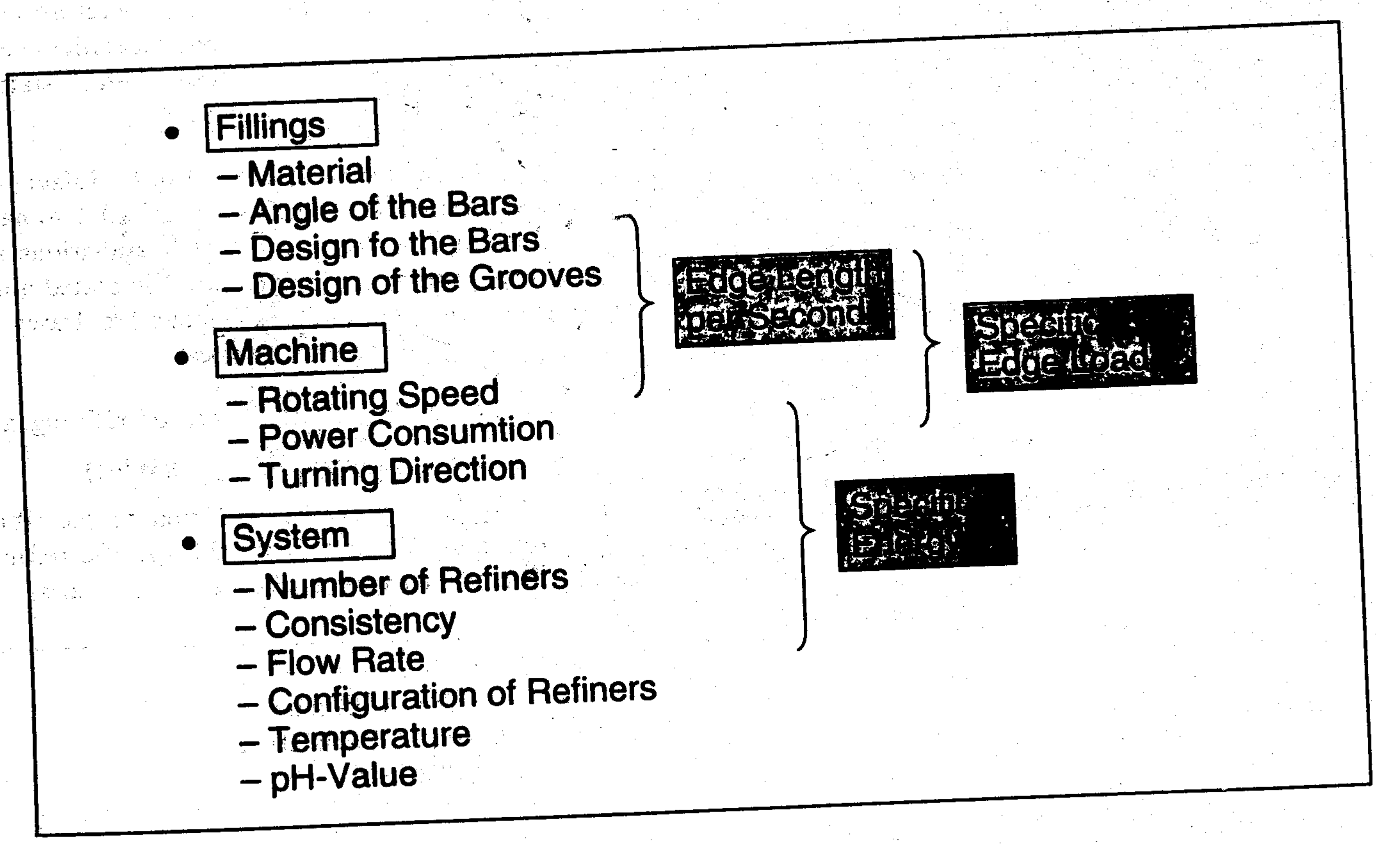

Fig. 2 : Parameters affecting the Refining Process

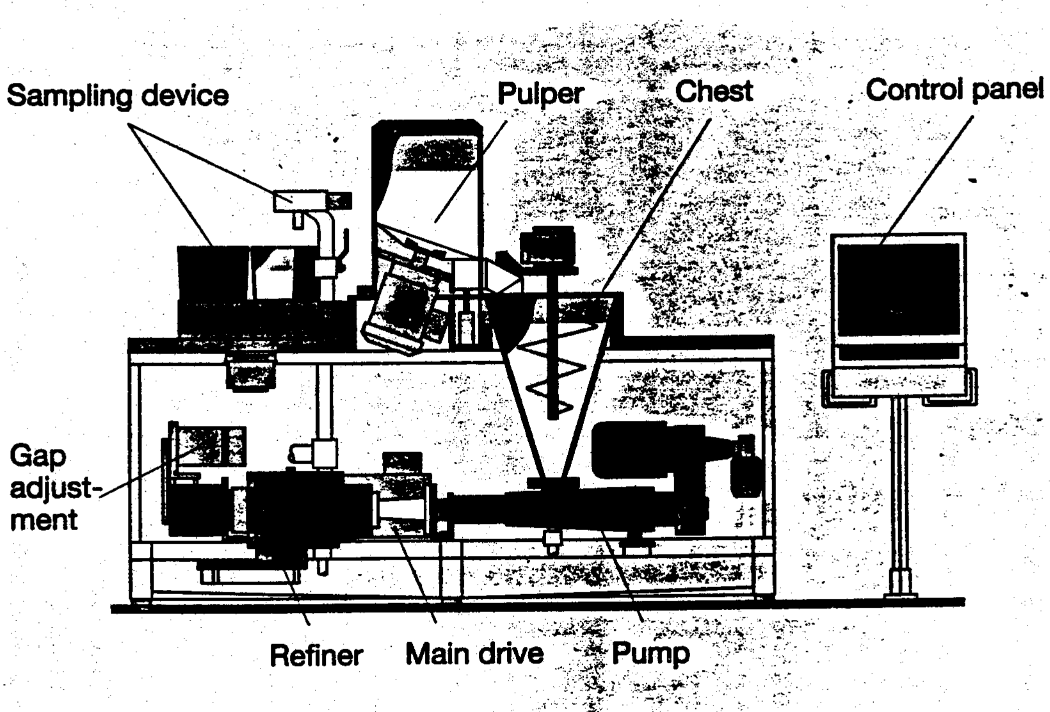

Fig. 3 : Voith Sulzer Laboratory Refiner LR1

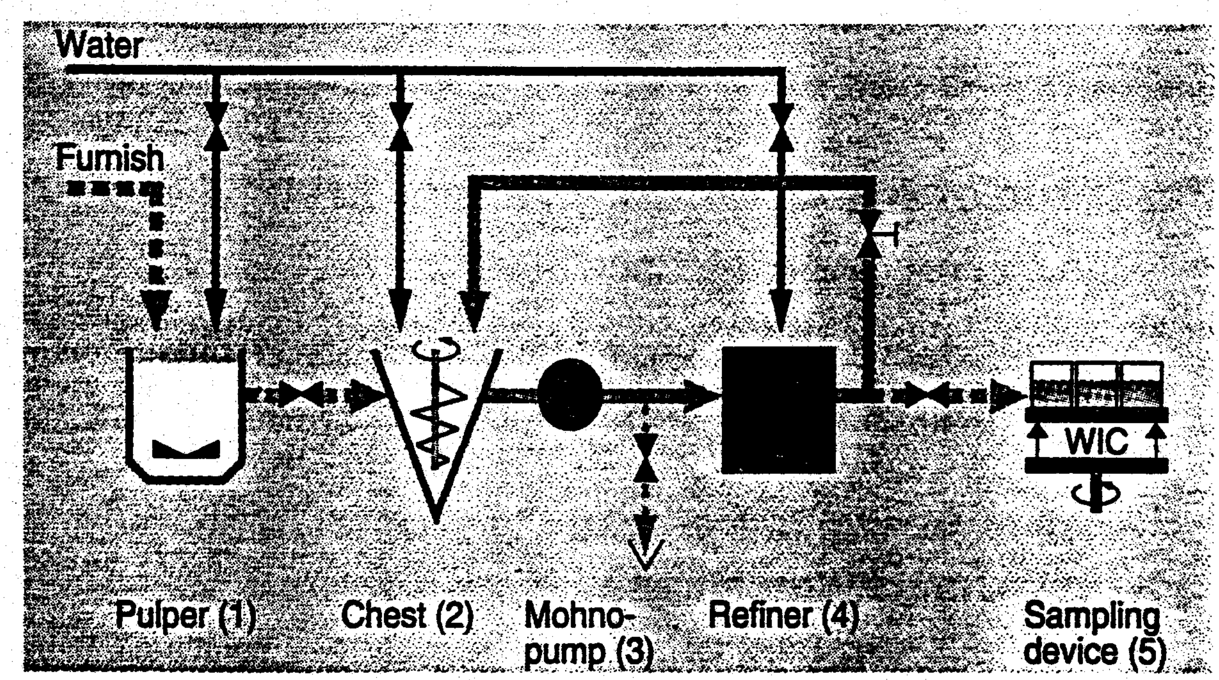

Fig. 4 : Laboratory Refiner Flow System

W_{spec} = $(P_e \times t)/m$

Where, Pe = Net Refining Power, kW

t = Refining time, hours

m = Stock quantity, tons

Specific Edge Load (SEL) : Bs (Ws/km)

This is the most widely accepted parameter to define the intensity of refining. SEL is the degree of intensity providing information on the amount of energy transferred to the stock via effective edge length. As SEL increases, the intensity of fibre refining increases.

B_s = P_e/Ls

Where Ls = Edge Length per second, km/s

Cutting Angle

The total angle generated by the interception of two bar edges when they are facing each other. It is also the weighted average of the sum of individual filling bar angles. The larger the cutting angle, more fibrillating and more gentle will be the refining treatment.

Laboratory Refiner LR1

The Laboratory Refiner has the following arrangements :

- Pulper (40 litre capacity, 3-3.5% operating consistency)
- Chest with Vertical Agitator (40 litre capacity)
- Sampling Container (6 x 2 litre samples)
- Rotary Table with sampling bucket and weigh scale
- Refiner with speed controlled DC motor
- Fillings adjustment facility
- Positive displacement (Mohno) pump, 50-150 lpm
- Control Console, Switch Cabinet and Printer

The entire arrangement is mounted on a compact table and can be run fully automatically from the control panel. This leaves the operator free to carry out other laboratory work when the refining is in progress.

Operation

The stock is homogenised in the pulper and then it flows directly into the chest. From the chest, it is fed to refiner by positive displacement pump where refining takes place between fillings.

Stock samples are collected in six buckets and weighed automatically during each test. Samples are taken at the instant when specific energy complies with the set point value.

CONCLUSION

We observed that the new Twinflo-D Refiner and Laboratory Refiner LR1 form an ideal combination to meet customers' requirement regarding product quality demands. While laboratory trials during pre-production stage would optimise the choice of fillings and refiner arrangement, the Twinflo Refiner would reduce energy consumption and improve product quality. A common goal of producing better paper would thus be better established.