

Wetend System Designs

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Operation of the wet end of paper machine being very critical at every stage, the design of the equipments and system should very carefully be done keeping in mind of the need for comfortable, flawless arrangement. As far as possible all causes of physical fatigue should be eliminated. Dependence on other section should be kept as low level as possible.

Keeping this in view a few areas have been touched for their design part to facilitate on easy working conditions.

The area confined to, is from stock pump to wire part only.

The classification of areas are as follows :—

1. Consistency Regulation—Dilution water connection
2. Refiner Design
3. Constant Head Box
4. Sand Trap—Introduction into the system
5. Centricleaners Sump level regulation
6. (a) Pressure Screen pressure regulation
(b) Rejects Handling
7. Cleaning of approach flow system/design
8. Deckle Spray & Deckle Strap
9. Trim knock showers
10. Wash roll doctoring
11. Wire return rolls/doctoring
12. Wire Tension

Some salient features of these designs above are discussed without going into basic details.

Consistency Regulation—Dilution Water Connection

Only the dilution water connection design is described here and not about the consistency regulator.

The dilution water line connection has been found to be playing a vital role in the continuous operation of Consistency Regulator. The conventional system of connecting it to the suction side of stock pump has several times resulted in jamming, either due to power

tripping resulting into back flow of stock into the line or leaking back water when supply pump is out of order, removed for maintenance.

Generally back water being used in various points may cause during power trip, back flow of stock from any to come to this line. Any paper machine man can understand the problems involved in getting this jam cleared as this calls for a machine shut. Even in places where there is a stand-by pump, "V/V not getting closed fully" or "Common suction Header" etc. are common problems. To prevent this the following design can be adopted as shown in Figure 1.

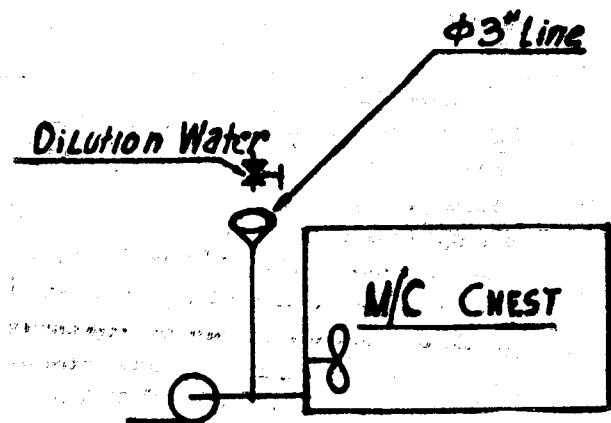


FIG.—1

On the suction line of the pump after the suction valve a 3-4" dia pipe may be connected to the height of machiner chest. The top end in the shape of a funnel and with water line and the regulating V/V. Any time this line water flow can be visually identified, the question of back flow is ruled out. This line shall always remain full with water because of continuous flow.

Refiner Design

While a full paper can be presented on this design we only touch the elementary change required in the design of conventional refiner.

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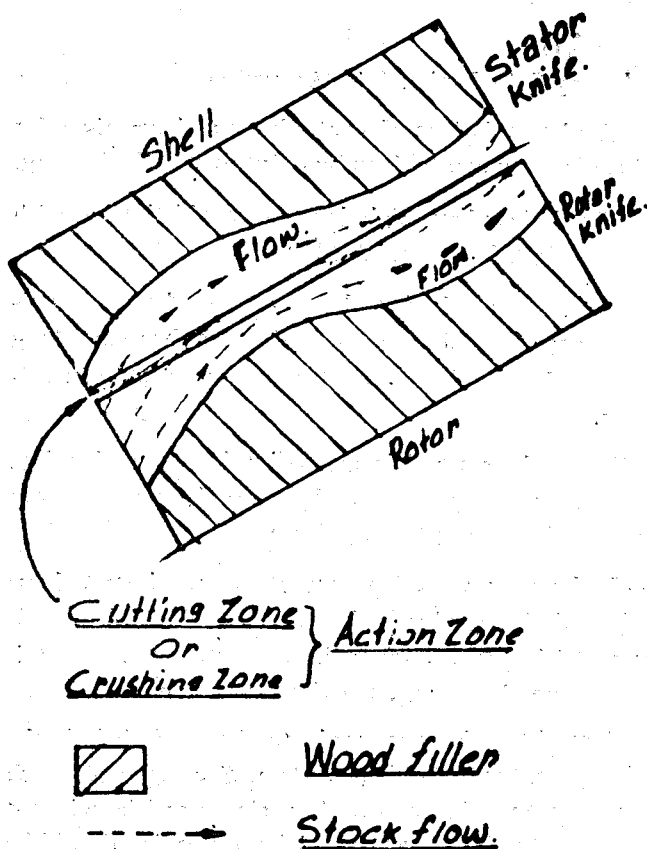
All designs of refiners have one thing in common.

The flow of stock inside a refiner is parallel to the knife. Several times it has been observed that the refiner has tripped but the stock continuous to flow un-interruptedly through the flute.

No testing or analysis has been done to find how the hydration is achieved, of the following 2 possibilities.

- (a) All the fibres getting hydrated to the same SR say 50° SR.
- (b) Part of the fibre getting heights hydration say 80° and part flowing directly at 20° SR contributing an average figure of 50° SR.

A positive refining can be achieved by adopting a design that ensures all fibres are subjected to the refining action. This can be achieved by designing the filler as follows, The rotor filler to have a convex surface and stator filler to have a convex surface correspondingly. See Figure 2.



The stock that enters with major flow through the rotor flute crosses the Action Zone to reach the discharge and through the starter cavity this. Number of hills and valleys can be varied, so that more number of times the stock can be subjected to pass through the cutting or Action Zone.

Constant Head Box or flow Box or Stock Regulating Box

Various designs of stock regulating boxes are in use, to regulate the stock flow through the substance control V/V under a constant head. It is well known that always some quantity is allowed to overflow keeping the constant head. But the obvious scene in many places is the entire box overflowing due to inadequate capacity of the overflow chamber to facilitate a free flow of excess stock back to machine chest, when the refiner outlet is yet to be throttled during the machine starts and the refiner is yet to be loaded. This results in the need to control the Input valve. In addition to this for more time in refiners, the delivery is also throttled during operation.

With this condition of operation, sometimes it is possible that the overflow ceases and no amount of substance control valve opening is going to increase the gsm. By the time it clicks and the operator checks up the overflow, adequate quantity of production is lost 15 ft. ladder climbing may have to be 3 times to control overflow from refiner outlet valve if a person is alone). A design that facilitates a visual observation of overflow shall help easy watch on this and quick corrective measures. Having a level control for this, is adding expenses and dependance on other section (Instrumentation).

Failures of automatic system takes more time for detection if not provided with alarm system.

The overflow arrangement is shown in Figure 3.

The wire boy at a glance can see frequently if the overflow is O.K. Climbing up a ladder and inspection arrangements leads to more chances of failure to inspect this.

This is nothing but a cut opening on the extreme wall of overflow chamber to make the overflow visible.

The overflow connection to machine chest should have the first line vertically down Figure 3A as far as possible and then the Horizontal line, so that adequate head is available for the stock to flow through the

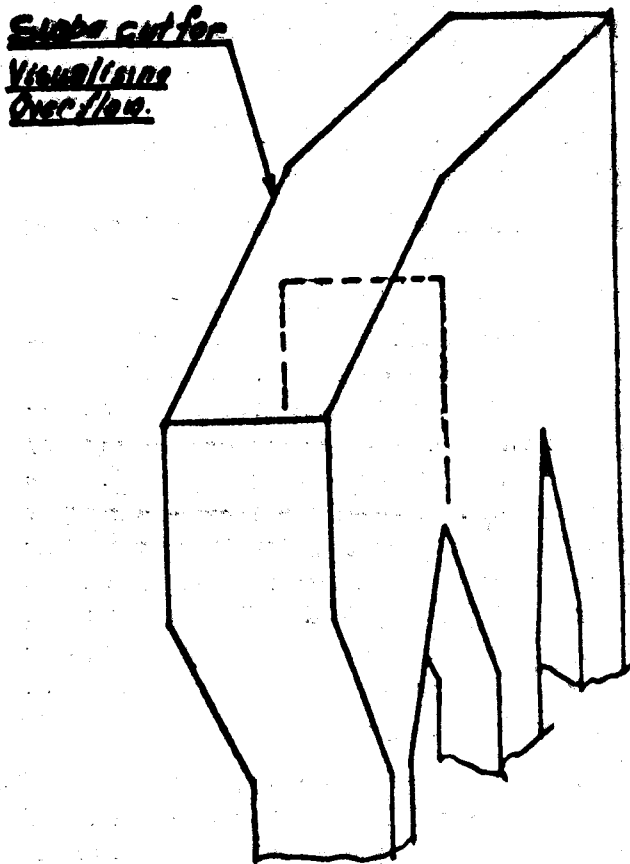
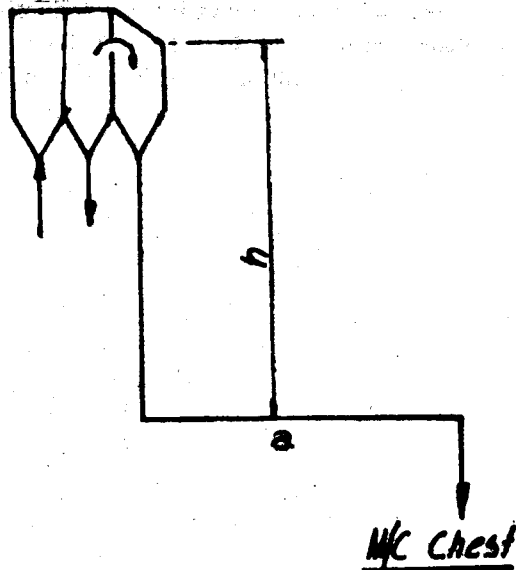
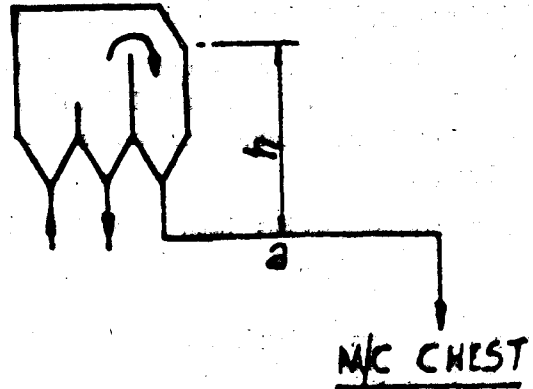


FIG-3



Well designed System
Horizontal section 'a' has sufficient
head 'h' for a free flow of stock
Hence SR Box shall not overflow
normally

FIG-3A



Poorly designed System
The horizontal section 'a' shall
call for more head than 'h' and
as it is not available SR box shall
overflow.

FIG-3b

Horizontal section. This is essential because it is a free fall-partial flow, and not an effective head.

Sand Trap-Introduction into the system

The latest designs of centricleaners have given lot of benefits to paper makers by offering superb cleaning.

The designs have high degree of sophistication with varying orifice from 6m, 10-12 mm.

After the stock has been subjected to a centricleaning operation in pulp mill, it passes through a long system gathering chances of foreign material contamination.

While these centricleaners offer thorough cleaning, if by accident some big size object such as metal scrap concrete piece etc. get along they will jam the orifice.

In the conventional system where we do not have level regulation gradually the sump level shall drop, this one centricleaner is by-passed, then-getting it cleaned-machine men know well the chain reactions.

A sand trap is proposed to be included in the beginning of the centriclean system. See Figure 4. Such arrangement would trap any big size particle without allowing it to C.C. System. The orifice dia should be about 1.1/2" with an enclosed rejection chamber. This sand trap should allow the entire stock to flow through. Counter current water flow shall offer visual assessment if provided with a rear light and sight glance.

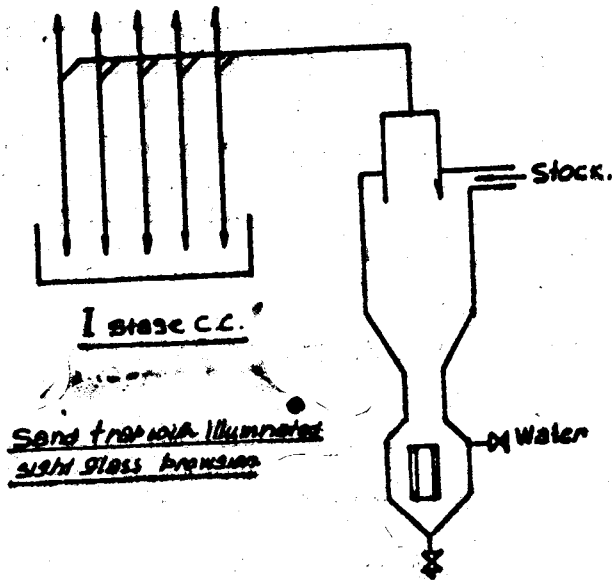


FIG. 4,

Centricleaners sump level control

The level control in the absence of instrument is by a float V/V. If it is felt that float controlled butterfly V/V maintenance should be eliminated, then the following arrangement shall be more beneficial and economical.

Conventional overflow is shown in Figure 5.

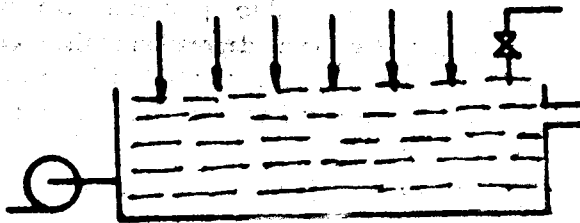
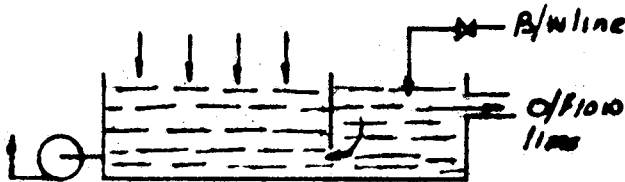


FIG--5

This does not ensure that Back water overflowing does not carry fibre from reject sump.

Connecting the dilution water to one side of the reject Sump and providing a partition with an opening at the bottom shall ensure that only back water overflows. Figure 5 A.



1st stage C.C. rejection sump with isolated back water overflow level control

FIG.—5A

The flow from the bottom opening shall facilitate only one direction of Back water flow as it is presumed that never the rejects alone shall be excessive unless in the case of pump failure.

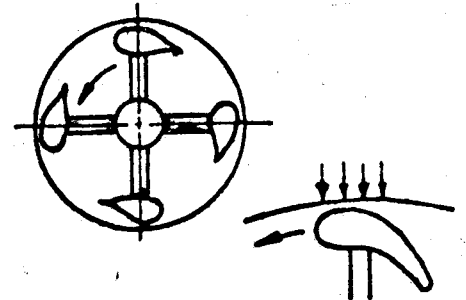
(a) Pressure Screen Pressure Regulation

Some cases of pressure screen's failure to deliver satisfactory performance has been due to keeping the inlet valve throttled.

It should be kept in mind that the screen jamming shall be more if the pressure difference at inner side of the cage and outside of the cage is very high. Best cleaning is achieved only if the pressure difference is minimum to allow only the requisite flow. The screen cage shall jam in no time if maximum furnish in stock is waste paper and inlet valve is used for controlling the Head Box level keeping the outlet valve open fully.

Seeing the reduction in output by-pass valve is opened for substitute. Ultimately the importance of pressure screen is lost unless some foreign material damages machine clothing.

Some machine suppliers who have daringly tried manufacturing pressure screens only with the visual knowledge have committed some mistakes which effect the performance greatly. The scraper design of rotor unit is shown in Figure 6. The thick end leading and



LIKE HYDROFOILS CREATING VACUUM WITH WIRE. THE GRADUALLY INCREASING CLEARANCE OFFERS A PARTIAL VACUUM CAUSING BACK SURGE.

FIG-6

tail end should lag. The gradually increasing clearance offers creation of depression allowing a back flow and a hydraulic surge that helps keeping the cage free from fibre deposition on the hole edge or partial mat formation.

b) Rejects Handling

Screening being a size separation process this calls for a better understanding when it comes to slurry screening.

The rejects shall have to flow out of system only with the medial of the slurry, which means a high percentage of acceptable slurry to carry a small quantity of rejects. Hence direct draining is fibre loss recirculating means process loss for the quantity and no exist for rejects. A small vibrating screen is the only solution.

The vibrating screen accept to be sent to I stage centriclean sump or fan pump inlet 0.25 sq.mtr. area vibrating screen with 20 mm hole dia standard plate should serve the purpose of a 50 TPD Machine. The frequency in the range of 1000-1400/min shall be the most suitable vibration.

A proper alignment and balancing of the screen tray shall ensure trouble free long time operation.

Cleaning Approach Flow System/Design

Various designs of approach flow have been proposed for proper full width distribution light weight paper, at high speeds have several times been very problematic by virtue of slime lumps. I can say no lump can escape through pressure screen's less than 2.0 mm dia hold and give problem in runnability of machine. Plenty of time has been wasted under such occasion in cleaning centriclean rejects, sump B/water/white water Tank etc. It has been experienced that the pipes from the outlet of pressure screen and upto Head Box i.e. the flow spreader system cleaning helps to a great extent and hence it is essential to provide adequate manhole provisions at the outlet of pressure screen to Head Box.

After identifying the impact of cleaning this area it was experienced that operating 30gm Airmail was a pleasure.

Deckle Spray & Deckle Strap

This is another important area which affects the machine operating economy if not designed properly.

Modern machines have good design of this with easy decoupling spray shower and multy position adjusting facilities.

An additional provision to vary the gap between the strip and wire, spot wise, along the length shall facilitate better control of sheet edge during requirement of higher deckle or during the short deckle operation when the wire has been trimmed for various reasons.

Conventionally a strip of rubber or such flexible sheet is connected to the deckle. This generally does not stay straight but only with some curves.

The Figure 7 suggests a design of deckle strip with provision to lower or raise at various points along its length. This design with a good uniform water spray should work better.

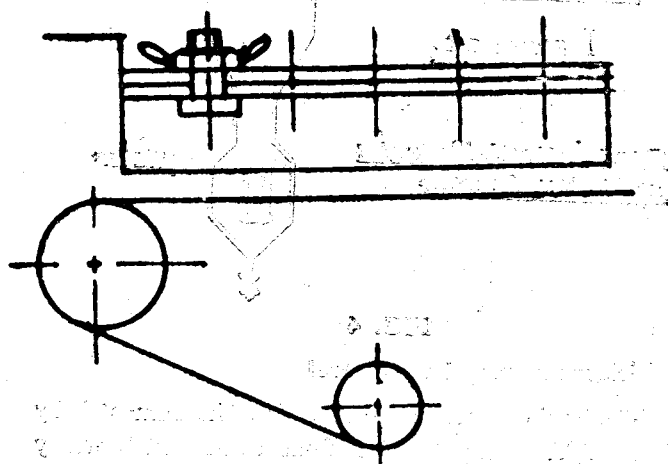
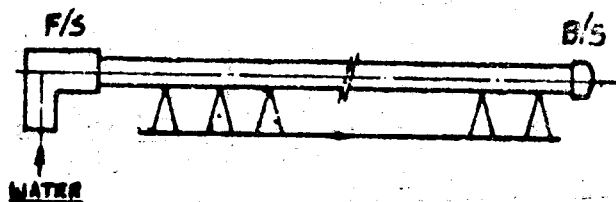


FIG-7

Trip Knock Shower

The importance of Trim Knock shower is multifold. "If the entire Trim is allowed to pass under the wire constantly it may develop a depression at the corresponding place on wire" is relatively of less importance when compared to partially knocked trim entering the roll under the wire.

Such partially knocked trim entering the roll under the wire causes minute dimples on the wire finally resulting in the holes in course of time. Hence instead of the conventional trim shower one on F/S and one on B/S which looses (specially B/S one) attention for cleaning, single shower with sprays nozzles on F/S and B/S alone shall help one stroke cleaning from F/S itself. See Figure 8.

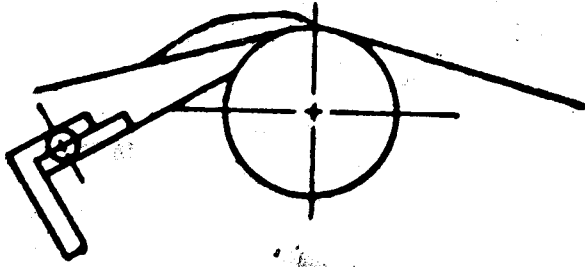


TRIM KNOCK SINGLE SHOWER
WATER CONNECTIONS F/S BRUSHING
COVER ALSO AT F/S.

FIG-8

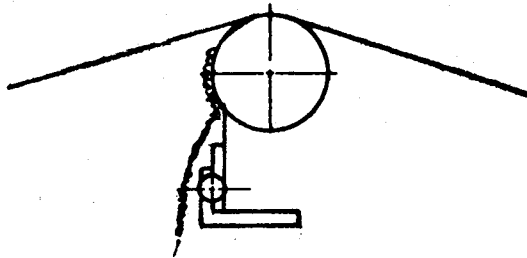
Wash Roll Doctoring

Another major problem is when the wash roll doctor position is not proper. It should be ensured that the wash roll doctor is situated at as low position on the roll as possible. See Figure 9-10



BAD DOCTORING
ACCUMULATES WEB

FIG-9



GOOD DOCTORING. ALLOW A FREE FALL
OF WEB

FIG-10

Improper position results into accumulation of web on the doctor blade resulting into undue damage to the wire.

Such a jamming also would result in to jamming of the roll with the doctor causing slippage between the roll and wire. In such cases if the roll is having a non uniform surface the wire will develop lines/ridges instantaneously or in course of time depending upon the magnitude of unevenness of roll surface and the degree of slippage.

Wire return rolls/doctoring

In general a very light doctoring only should be designed on wire return roll if the contact is good and uniformly sharp. If the load of doctor is more on the roll it shall cause some slip in speed with respect to the speed of wire.

Within the practically available facilities such as quality of doctor blade water hardness etc. it is very difficult to keep the roll surface uniform for a long time. No doubt very few mills have been able to achieve this.

During the course of running, the roll develops a non-uniform surface which can be observed in one roll or other during a wire change. These grooves are harmful to the wire specially when the roll is not fully assuming the speed of wire (either due to bad bearing or due to heavy doctor). These grooves shall cause ridges on the wire because of the rubbing action caused due to the differential speed. Hence on the rolls inside the wire loop its preferable to lift off the doctor during normal run.

It can be used only when machine is started after a power dip or such sudden stoppage which would have resulted into excessive stock overflow from the wire on the sides.

Wire tension roll

Swing roll, the crudest and oddest form of keeping constant tension roll is good enough for a machine if it does not have a tension roll. While the general standing is that it takes up the tension variation, a better notion shall be to say that it accommodates the elongation of wire during the normal course of run. It is not advisable to maintain a Condition which calls for the F/S and B/S i.e. the tender side and the drive side to have a different counter balancing weights. It is always preferable only to allow it to be parallel to the machine width. Hence the design should consist of a Tie rod and the roll fitted to one side of the lever, with provision for adjustment of the length of the lever.

It is preferable to provide a support at the bottom giving a clearance of 1" or 1/2". This will prevent the wire from getting burst across the width in case of an unnoticed bigger edge crack or such, so that a mid-night wire change can be avoided.

Intermittent watch on the position of clearance shall be helpful. In high speed machine with pneumatic stretch/tension rolls it is all the more essential to provide a stopper arrangement with a clearance of 1/2" and to check up the wire if suddenly this clearance is closed.

Conclusion

We may also suggest inclusion of an additional heading in the monthly stoppage/down time analysis report, "reason not clear" and allowing the concerned person to put down whatever is his observation so that those can be observed by others too and a concrete solution can be worked out.

The people on the floor should be given a confidence that there may be some problems beyond their reach for which solution may be available with others and allow them to frankly come forward to discuss with all their observations, so may be set a healthy technical atmosphere in the Indian industry