Wet felt designing techniques and its application

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SUMMARY

In the process of paper making there has been rapid advancements in various Sections but Press Section needs special reference. The ingenuity on part of designers and machinery Manufacturers could bring out various types of pressing techniques as a consequence to this dewatering capabilities in Press Section increased enormously. The credit in no less degree can go to felt designers who are responsible for developing various types of felts to suit particular press design. Looking back in fiftees, the moisture entering in the Dryers in the region of 62—65% was considered standard figure. Now the figure stands at 56—58% or even less and this is in no way a small achievement. There has been tremendous innovations in felt designing in last two decades and these improvements are viewed particularly for their gainful application in paper mills. The rightful application of these new techniques could yield advantages in the form of improved production and cost reduction & energy conservation. Considering that small scale industry cannot take massive renovation in press Section to take advantage of latest pressing techniques but development in felt designing can be applied with meaningful results. The scope of this paper is therefore restricted to felt designing techniques and its application.

INTRODUCTION

Eversince the advent of continuous sheet manufacture, paper machines have undergone radical changes in the areas of water removal in wire part, press section and dryer Section. Although basic principle of sheet formation of continuous web has remained the same but machine speeds have increased tremendously as a consequence to effective removal of water at wire-part, press part and efficient dr ing The object of this paper is to present in layman's language about the fundamentals of various pressing concept for better understanding of operation of press Section. The efficient operation of press section is an effective tool in the hands of paper makers leading to improved production and thereby cost reduction.

PRESSING

It is essential that optimum operating conditions are established & most effective felt design is applied. The single most easily changed variable in press section is the press felt and in order to select a suitable felt it is must that there should be proper understanding of fundamentals of pressing and techniques of felt designing. The press works as continuous system with paper sheet entering and leaving with different moisture content with net removal of water as net result. The way water is extracted from the system is important for the efficiency of pressing operation. The analysis of the nip conditions confirm basic mechanisms as being the compression of paper in the ingoing part of the nip, resisted by pressure in the structure and the fluid flow through paper and felt, also rewetting in expanding outgoing nip thereby transferring water from felt to paper. In the plain press nips, the water flows by gravity from the nip. For all transversal flow nips, special arrangements are needed to remove water from the system. Machinery manufacturers have designed various types of presses to create water receptacles under the felt suction roll, grooved rolls, Blind drilled rolls whereas felt designers have provided various structures and compression properties in felt so that water handling is enhanced. The fluid flow component is the only major dynamic mechanism in pressing and is dependent on pressure, basis weight, speed, nip width and drainage resistance. The uniformity of pressure application is dependent

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on characteristics of the felt. Mid nip dryness will be determined by specific pressure applied in the nip, compressional characteristics of the mat and flow resistance in the system. For optimizing mid nip dryness, the felt designer has minimized the flow distance through the felt by needling technique and water receptacles are provided in the felt structure itself. The progress had been from ordinary 100% woollen woven felts, to 20-25% synthetic component in the felt to 50-100% synthetic needled felts. The felt structure has been changed from batt-on-base to batt-on-mesh. The choice of base in the batt on-mesh felt is single, double or tripple layer is very much based on the amount of void space and compressibility required in the felt. The void space-the actual or space inside the felt which will hold water, depends on the wt. of sheet, machine speed & if type of conditioning is poor e.g. there is no felt vacuum box or very little vacuum capacity in it, void space in the felt should be lower so that felt carries less water as most of the water should be expressed at the press nip. The degree of compressibility needed in the felt i. e. resistance to compassion is determined partly by press nip pressure. If nip pressure is high the felt must be able to withstand it without compacting and therefore more incompressibility is needed in the felt Generally the higher the nip pressure, the less compressible the felt. Single layer base will have more compressibility and being thinner will have less void space, than a double layer base or tripple layer base.

When considering single layer, double layer or even tripple layer design, various factors have to be taken under consideration i.e. type of press, type of paper grade, furnish, press loading, speed of machine and very important factor is conditioning equipment, full width suction box and showers. In general paper maker is looking for either improved felt life, improved machine effiiciency or solution to certain problems like shadow marking. press picking or crushing. Moving from Batt-on-base felt to single layer batt-on mesh felt should yield improved felt like and increase in the amount of water removed from the sheet provided there is full width suction box. But at this stage some other problems may be prevalent like shadow marking on suction press or there may be some need to increase the loading on the press. In order to achieve this we will need to move to a bigger void volume felt i. e. double layer. Having got to this stage we would expect again provided good conditioning equipment, a felt giving excellent life and improved runnability.

Once again to final move up to 'tripple layer' is usually decided by customer who is basically looking for improved performance i. e. further increase in press loading, better water removal or still find himself having a particular on M/c problem which could only be solved by a new felt style. It does not necessarily follow that felt life will increase when moving from double layer to tripple layer felt.

Tripple layer base is very incompressible and therefore needs very high nip pressure both to press water into it and out of it.Unless nip pressure is very high i.e. say 75 kg/cm plus, the triplex will not dewater very much but it will simply run round acting more as a transporter and not adding to efficiency of press dewatering. Lifetime of such a felt will be very long because it is hot compressed. However, its water removal will be very poor.

The secret therefore of a good wet felt selection is to select a good compromise between good water removal and long life. This means carefully considering how much void space and compressibility to build into the felt, partly be the choice of base, apart from other factors.

In general the principle behind "Batt-on-mesh" felt is incompressibility combined with new terms called void volume, the bigger the mesh structure the greater the void volume, the greater its water handling capacity. If we look a little more closely at this term "void volume" it would highlight the dewatering capabilities of each quality—

Void volume of batt-on-mesh structure

	Mesh wt.	Strucutre caliper	Full saturated wt.
1. Single layer	265	1.02	1059 gsm
2. Double layer	518	1.68	1744 gsm
3. Tripple layer	900	2.81	2927 gsm

These figures are not absolute but are related to one particular supplier design.

The void volume loosely described as saturated wt. shows the huge potential of felt structures available in today's market.

CASE STUDY

Medium size mill producing 25 t day writing/ ptg. grades on single machine. Batt-on-mesh felts in comparison to needled felts are expensive but this extra cost is amply offset by long life attainable on batt on-mesh felts and other gains Life of batt-on-mesh felt is at least 2.5/three times that of batt-on-base felts. Other advantages are saving in

downtime as less felt changing would be required. Another major advantage would be saving in steam costs. Following is the nett gain :

— Production	: 25 t/day
— Steam cost	: Rs. 100/t steam
— Steam consumption	: 3.2 t/t of paper
— Moisture entering the dryers with batt on base felt.	: 62%
— Moistur entering the dryers with batt on mesh felt.	; 60%
— Steam saving based on 4% saving on every 1% moisture reduction.	: 0.256 t/paper
— Steam cost saving per t/ paper	: Rs. 25.6
— Life of batt-on-base felt	: 1.5 months-yearly requirement 8 felts
— Life of batt-on-mesh felt	: 3.5 months-yearly requirement 3.5 felts
— Time required for felt change	: 1.5 Hr.
— Time required for Batt–on–Base felts changing/yr.	: 12 Hrs.
— Time required for batt-on-mesa felts changing/ yr.	: 5.25 hrs.
— Time saving/year	: 6.75 Hrs.
— Profit per hr.	: Rs. 1C00/-
— Saving due to downtime reduction.	: Rs. 6750/-
— Yearly cost of batt-on-mesh felts.	: Rs. 40000×3.5= Rs. 1,40,000
— Yearly cost of batt-on-base felts.	: Rs. 13000×8= Rs. 1,04,C00
— Extra cost for running batt-on-mesh felts.	: Rs. 36000/-
— Add energy cost for running conditioning equipment.	: Rs. 87,912
— Total	: Rs. 1,23,912

Less-Felt changing downtime	: Rs. 1,23,912 minus
saving	Rs. 6,750 =Rs. 1,17,162
Steam saving at 25.6 per t	: Rs. 2,33,600
Nett gain	: Rs. 1,16,438 Say Rs. 1.2 Lacs

RECOMMENDATIONS

It would be worth a consideration to try batt-on-mesh felts in place of conventional or batt-on-base felts after providing adequate cleaning arrangements.