Machine clothing--Mysore newsprint machine

SHYAMSUNDER, R.*

The Mysore Newsprint paper machine was started in July 81. This Beloit paper machine comprises of Bel-baie II twin wire forming section with hydraulic converflo headbox. The tri-nip press section consists of steel venta controlled crowned rolls for first press bottom and third press top position. Rubber covered suction press roll and granite roll are the other two of the four roll trinip press section. We have 36 cylinder 4 group conventional dryer section with rotary syphons and 3 group cascade steam and condensate system. The machine is designed for an operating speed of 650m/min and the trim width at pope reel is 6.8 meters. The machine is designed to produce 331 MT/day of 52 gsm Newsprint at 100% efficiency. The raw material is 70% to 80% Eucalyptus, cold soda refiner mechanical pulp and 30 to 20% bamoo and mixed hardwood chemical pulp.

In this paper, I am mainly discussing on the modifications made on machine to improve life of clothing, cleaning efficiency and runnability of machine. Later in this article I discuss on the future improvements we plan on machine to improve the machine efficiency both in terms of runnability and cost per tonne of paper made. Finally I will discuss on the economic feasibility of the improvement/ suggested.

From the startup of this machine we have damaged, removed prematurely many fabrics wet felts and dryer screens due to defect in alignment, failure of interlocks, wrong positioning of equipment, inefficient cleaning, reduction in machine running efficiency and manufacturing defect in the clothing. We have made many modifications and corrections on the machine to improve fabric felt life, reduce the chances of damage, improve the cleaning method and the runnability of machine. We have used felts and fabrics of different designs from the various manufacturer to get the best life and runnability of machine and maximum sheet dryness after press.

Bel-baie Section

The Bel-baie consists of the No. 1 wire or backing wire and No. 2 wire or the forming wire. Both are 100% synthetic wires. The forming wire has no roll in the outside loop whereas in the backing wire there is a mount hope roll for spreading the wire before entering the forming roll. The normal expected life of backing wire is 2½ months and that of forming wire is 2 months.

a) Creasing of wire

The first few month after starting we have lost many forming wires due to creasing while starting or stopping the Bel-baie section. Wrinkles in the wire were developing between the couch and forward drive roll. We observed ripples during running. The ripples moved towards both edges from the centre and the ripple moving faster towards drive side. Ripple moving towards both edges is caused by roll deflection and concave rolls Ripple moving towards drive side is caused by fabric being tight on backside. In the early part of 1982 we stopped the machine, levelled the rolls and ground the rolls to a camber of 80 microns After starting, the wrinkling of wire has reduced and the life of wire has improved substantially. Here, I would like to mention that for a twinwire machine with short wire length the alignment of roll and other elements should be correct. Recently we have checked the squaren ess of rolls and other elements with theodolite and the defects recorded would be corrected during the next long shutdown. In all high speed machines the alignment of rolls and other elements are checked periodically. The rubber rolls should be

*The Mysore Paper Mills Ltd.,
Bhadravati-577 302

ground periodically to the required camber. In the last two years of running this machine we have ground most of the wire rolls.

b) Wire Damage

During commissioning and subsequent few month we have damaged few forming fabrics due to tripping of press, failure of compressed air, failure of couch vacuum. failure of pickup vacum, etc. Before commissioning we had interlock for raising the pickup roll on failure of couch vacuum. We introduced a manual/auto switch to facilitate by passing the interlock at startup until sufficient couch vacuum is attained. Later we introduced interlocks to raise pickup roll on failure of pickup vacuum and tripping of Bel-baie and press on compressed air failure.

c) Cleaning

The best way to clean a forming wire is not to get it dirty in first place. The mian problem we are having is cleaning of wire. Originally fan jet inside cleaning shower for No. 2 unit and outside cleaning shower for No. 1 unit were provided at a pressure of 18 kgs/Cm2. The fabrics used to get dirty very frequently event with only 2 days of running. To improve cleaning and runnability we are adopting the following.

i) Increased the cleanning shower pressure to 22 kgs/Cm2, the maximum attainable with the present pump.

ii) We have removed the outside cleaning shower on No. 1 position as this had a tendency of carrying the water to headbox lip and disturb the formation. (We have no exhaust system in Bel-baie). We removed the inside spreading shower in No. 1 unit and installed the cleaning shower in this position.

iii) Regularly we clean both No. 1 wire and No. 2 fabrics with dilute hydrochloric acid at 2-5% concentration, during running of machine. We clean the wire with acid in the return run and the acid is knocked down by the cleaning and knock off shower. This avoids paper breaks during cleaning.

iv) During any shutdown we clean the fabrics thoroughly with dilute caustic at 5% concentration. This cleans the wire very effectively.

v) Earlier we had connected the recovered clarified water for the high pressure cleaning shower. Due to contamination of this water the filters used to get jammed as well as the shower nozzles. To avoid this we are using the filtered water for the cleaning showers.

With the above we are able to keep the wire cleaner but not to the degree desirable by us. To improve the cleaning efficiency further and thereby runnability and formation, we plan to implement the following :

i) As the present cleaning shower system is not effective in keeping the wire clean, we plan to instal a 40 kgs/cm^2 pump and provide needle jet cleaning shower. Apart from cleaning the wire the 35/40 kgs/Cm^2 high pressure shower will facilitate us in studying the performance of the double layer fabric which we have in stock.

ii) At present we are using polydisc clear water for the wire roll showers. Due to fibre contamination of the clear water, the shower nozzles are getting plugged. The lack of roll lubrication shower and the fibre in clear water affects the doctoring of the wire rolls which in turn affects in keeping the wire clean. To avoid this we have changed the source of water for the roll showers, from clear water to recovered fresh water. Both the recovered clarified water which was used for cleaning shower and the polydisc clear water which was used for roll showers are being used elsewhere effectively to maintain the water consumption at the minimum.

iii) In the No. 2 unit we have no outside roll. As the tendency of the No. 2 wire to crease is more on our machine, we intend installing the spare mount hope roll in the forming wire loop before entering the breast roll In all high speed Bel-baie machines normally an outside roll is provided in the return run to act as a wash roll and direct the wet sheet into the couch pit.

Installing the mount hope roll in No. 2 wire loop will not only spread the wire but also partly act as an outside wash roll to prevent the sheet jamming between head box lip and breast roll. The mount hope roll should have a good cleaning shower.

iv) The carry over of the sheet along with the forming wire and jamming at the head box lip during starting of machine and whenever the pickup is raised is happening frequently on our machine. The pulp accumulated at the

lip is cleaned after picking the sheet. During cleaning sometimes a wad of pulp is carried along with wire which can damaged the press felts, especially the 3rd press felt. To facilitate sheet knock-off we are installing a multi fan flooding nip shower to deliver water to the inrunning nip of the forward drive roll. A shield will be provided to avoid the separated sheet falling on the first press felt. The shower will be interlocked with the pickup vacuum to shut off when vacuum is on and open on vacuum. The shower will be a 30° fan, low pressure in the order of 5-8 kgs/Cm^2 and high volume shower.

Using the principle of flooding nip shower we also plan to install a edge/trim flooding shower. At present we have machine paper breaks due to trim carryover to head box lip. The trim flooding shower will be run continuously and it will also reduce the edge wear.

For high speed paper machines, both fourdrinier and twin wire machines, a wash roll knock off system or a flooding nip shower is required for good sheet seperation and knock-off into couch pit.

v) We intend to provide an exhaust system for Bel-baie to remove the mist of water vapour created by the jet, the high pressure shower, etc. An exhaust system for twin wire machines is necessary to keep the forming section clean, to reduce the corrosion of equipment, facilitate cleaning of the forming section during running, improve runnability and formation.

d) Fabric Design

At present we are using only single layer fabrics on our Bel-baie machine. The fabric we are using is 4/5 shaft weave with 30 mesh/Cm. The warp thread diameter is around 0.2 mm and weft thread diameter is around 0.22 mm. We have used fabrics with upto 0.25 mm. weft diameter to improve stability and reduce the tendency to crease. With the present improved quality fabrics the wire life is satisfactory, the sheet formation is acceptable and the first pass retention is around 50% which is good compared to other Bel-baie machines running in the world.

The quality of the fabric-weave, uniformity and stability is very important. Good retention of fines which is essential for Newsprint opacity and printability is achieved by controlled weaving giving uniform hole dimension over the entire area of the fabric. Individual monofilament tension control is very important for preventing buekling which acceierates creasing. Proper heat setting of fabric is necessary for the fabric to run flat.

Selection of monofilaments for the fabric is important. On our machine, to improve the fabric stability and reduce creasing tendency, we we have changed the warp and weft thread diameters. Bigger diameter monofilament resist wear. But smaller diameter is required for better retention and reduced knuckles for non-marking. Smaller diameter threads reduce life and bigger diameter improves stability. So, for manufacturing the fabric the optimum diameter threads have to be chosen depending on the type of forming section, the problems faced on machine, the cleaning system provided, the type of furnish, speed of machine, quality of paper made, etc.

Many twin wire machines are changing to multi layer fabrics to improve retention, to improve the runnability of machine and sheet formation. The dimensional stability of multi-layer fabrics is good and it gives a longer running life. Till now we have not been able to try multi-layer fabric on our machine due to inadequate cleaning system. Once, we instal the flooding nip shower and the high pressure needle jet cleaning shower we will study the performance of multi-layer fabrics.

Press Section

We have the well proven tri-nip press section with stainless steel grooved controlled crown rolls in first press bottom and 3rd press top position. The operating nip load in the three presses are 65, 80 and 95 kg/cm.

First let me discuss the changes we have adopted in the felt conditioning system to improve the press performance and the efficiency.

a) Mechanical felt cleaning system

For the mechanical conditioning of the felt we have the three systems :

i) The low pressure flooding shower
ii) The high pressure system
iii) The uhle box, the lubricating shower and vacuum system.

i) The high pressure shower provided earlier for felt cleaning was the 60 kgs/cm^2 pressure

oscillating needle jet shower positioned inside the felt circuit. The three high pressure showers for the three felts were being operated alternatively. The wear on the felt due to the high pressure was more. The longer the shower was run the more the fibre shedding. So the duration of the high pressure cleaning was reduced and it was operated only for 15/20 mins. per felt per shift. Trial was taken with lower pressure to avoid wearing of felt but the cleaning efficiency was affected.

Due to the short fibre wood which we use-for making pulp, lot of fines are generated in the system. The main reason for filling up of felt, in our case, is due to fines in the pulp stock. These fines could not be removed effectively by the high pressure inside cleaning shower. So, to improve the cleaning efficiency we relocated the high pressure shower in the face side at an angle of 30° against the felt travel to provide a doctoring action. We reduced the shower pressure to 15 kgs/cm² for new felts. The showers are run for longer duration upto about 2 hours/shift for new felts. As the felt is run for a few days it gets compacted and cleaning the felt is more difficult. So, to have an effective cleaning we increased the shower pressure gradually to a maximum of 35-40 kgs/cm² for wornout felts.

By relocating the high pressure shower on the face side at an angle against the direction or movement and reducing the pressure and operating for longer duration the cleaning efficiency of felts have improved, the fibre shedding has reduced, the bulk of the batt layer is retained for a longer time resisting compaction, the felt has retained its permeability for a longer period and the life of felts has extended.

Here, I would like to add that after changing the high pressure shower on pickup felt from inside to the face side, which was done only in June 1983, we are having trouble in sheet pickup. At the same time when the shower position was changed the pickup roll was removed for cleaning. Suspecting that the sheet pickup problem is due to surface of felt becoming tangled, the shower angle has been changed from 30° against the felt travel to 30° along the felt travel and the pressure has been reduced. As the low zone vacuum in pickup roll is fluctuating, the sheet pickup problem may be due to improper fitting of seal strip which will be checked during the next shutdown. The pickup problem may also be due to the felt design as at the time of manufacture of the felt the vendor was informed that the high pressure shower was was directed from inside to outside. This problem is being studied.

ii) We have the straight slotted suction boxes, 2 for pickup and one each for bottom felt and III press felt. The slot width originally provided was 25 mm. Severe felt wear was happening with this wide slot due to deformation of the felt in the slot by the vacum and the friction on the slot edge. The cleaning efficiency was also low due to high air flow requirement and maximum vacuum obtained was only 15 to 20 cms of water gage.

To obtain good dewatering/cleaning efficiency with the suction box we reduced the slot width to 12 mm. The dewatering of the felt improved but the slot used to get plugged with fibres frequently. To avoid plugging the slot opening was increased to 15 mm.

b) Chemical cleaning of felts

we clean the felts regular, during any shut down for more than one hour, with 2% - 5% caustic and 2 kgs of detergent each time.We clean the felts at least 2 times in a week. This way the contaminants are removed by emulsification or dispersion. This type of cleaning is adopted during shutdown.

During running of the machine the felt is conditioned by acidifying the shower water to a PH of 4 to 5 with sulphuric acid. This helps in dissolving the aluminium hydroxide precipitate formed by reaction of alum in paper with the shower water. It also helps in disolving the calcium and magnesium deposits on felt present in hard water. The cleaning of felt with acid during running is not done regularly at present. We are providing a system for adding acid continuously into the felt water tank with the help of a dozing pump to maintain shower water PH same or slightly lower than that of the stock.

Felt type

We have tried felts of different designs from the various manufacturers for the three positions namly, pickup, 1st bottom and III press top positson To start with, we used batt on base felts, 100% synthetic. for pickup and 1st bottom position and 30% wool content felt for III press pasition. These

felts used to get plugged quickly, the felt used to get compacted and loose its permeability. In the hard nip 3rd press position the fibre shedding was more and the life and performance of the felt was very poor. The felt had poor resistance to damage. With the experience of the type of felt tried so far, I can say, that the felt required for the 3 positions on our Newsprint machine, using 75% ecualyptus mech pulp and 25% chem. pulp furnish should be of following design to obtain good machine runnabililty, good cleaning, vibration free, long life, and maximum sheet dryness after press:

i) Pickup felt: Most of the felts used in the pickup position for the last two years were removed due to plugging and compaction which resulted in impaired pickup properties, reduced moisture removal and uneven moisture across the width. One felt was removed due to vibration and one got damaged during running. The pickup felt should have good pickup properties, high adhesion between web and felt, good dewatering properties, good permeability and little tendency to clog, durability, good running properties and dimensional stability. With the furnish we are using, I would select a 100% synthetic, batt on mesh pickup felt, preferably with double layer base and with good parmeability of around 100 cfm. The felt weight wou'd be around 1200 - 1250 gsm for double layer and around 1100 for single layer felts. The normal expected life of pickup felt would be around 45 days of running.

ii) In the bottom first press position which is double felted we have had no problem so far and felts have run for more than 2 months The felt for this position would be 100% synthetic batt on mesh felt. The weight of felt would be around 1000 gsm. There are chances of rewetting in this nip and the felt should be designed to minimise the reabsorption of water from the grooved roll. The felt should be able to retain its bulk and the original permeability over an extended period of time.

iii) The most critical felt is the hard nip third press felt. Here, the nip load will be around 95 kgs/cm and the nip is between a stainless steel controlled crown grooved roll and granite roll. The paper web is also drier as it enters this nip. Due to the hard nip the felt may give rise to vibration and has a high chance of getting damaged. In the last two years 65% of the total number of felts used in this position have been removed due to damage during running, 20% have been removed due to heavy press vibration and 15% was removed due to wearing. The wearing of felt in this position is very fast but we have had lot of damages of felts before it is wornout. The felt for this position must resist wear and crushing damage, should dampen vibrations, should have good resilience and good permeability. Apart from the batt on base felts, we have tried 100% synthetic double layer, the so called two and half layer and three layer base, batt on mesh felts. The best result we have obtained with the three layer felt. The felt gave a long life, kept clean and open, retained most of its bulk and good dewatering characteristic. For this position I would recommend a three layer base batton mesh felt. The weight of the felt would be around 1450-1500 gsm. The base would be monofilament threads. The base to batt ratio would be about 60 to 40.

To reduce the chance of damage to the felt due to probable pulp was coming in this nip during startup, the nip load is reduced before picking the sheet from Bel -baie. After the sheet is picked up and the pulp jamming. if any, between the headbox and breast roll is cleared before the press load is increased.

For the furture development and improvement in the press section we can think of installing a steam box in the suction press turning zone position. At present the paper entering the dryer section is about 43% dry The installation of steam box would increase sheet dryness by about $1\frac{1}{2}$ to 2%, increase the web strength between the press and dryer, reduce the steam consumption per tonne of paper and help in controlling the cross machine moisture profile.

Dryer section :

In the dryer section we are using dryer screens with pocket ventilation duct. The stability and performance of the screens are good. The steam consumption per tonne of paper is around 1.8 tonnes. In the beginning we lost couple of screens due to jamming of paper between the pocket ventilation duct and the dryer cylinder. To avoid such damage the gap between the duct and dryer cylinder was increased. We damaged one dryer screen due to heavy wrapping of paper on the cylinder. Now we have coupled an alarm at wet end with break detector system so that the wet

end operator can cut the sheet at press when there is a dryer break.

Regarding cleaning of dryer screens we clean the bottom screens once every shift with compressed air hose during running. For the top screens we have installed an air shower for the 1st top screen which is operated at regular intervals. Ater studying the performance of this shower, provisions for other screens will be made.

In the near future we plan to try single felting in first section and subsequently in the second section. This should reduce the fluttering of paper in the first section and mainly avoid accumulation of fluff in the dryer cylinder, thereby reducing the number of breaks in dryer section. These are the two main problems we are having at present though the fluttering of paper is not severe at the present operating speed.

In some of our screens, especially in the 2nd and 3rd group, the seam bowing is quite serious. The bow is normally symmetrical which is due to bending of felt rolls. This bow causes loss of screen width, variation in tension and permeability, poor guiding and slack edges. To overcome this problem we are going to grind one of the felt roll with maximum warp to a negative camber. The amount of camber can be decided only after trial.

Economic aspect of clothing:

Finally I would like to discuss on the economic aspect of clothing and on the investment and running cost of new equipments suggested. Earlier in this paper, I have suggested to use better quality of felts and fabrics like a three layer felt and double layer fabric (which are expensive). We plan to instal high pressure pump, needle jet showers, mount hope roll and flooding nip shower in Bel-baie which involves investment and higher operational cost. As I have said we are going to make the chemical cleaning of felts more effective and continuous. This involves investment on chemicals. In future we may go for a steam box in press section which involves heavy initial investment Before we invest on the above we have to study this from economic aspect and see whether it is profitable to go for higher investment. Here, in my calculation I have assumed some of the figures from paper making experience I have had on this machine. The figures given are only indicative and not actual figures.

In the past, clothing life was critical and was evaluated on days of run or cost per tonne. Today it has been realised that paper making performance is more important to the clothing life. The clothing performance should be analysed to show its impact on the total paper machine economics. The cost of the clothing must be seen in relationship to the production and to the production rate so that the total economy of the process is optimised. The clothing cost per tonne is small in comparison to other paper machine manufacturing costs. Minor changes in clothing performance will effect major gains in machine productivity, efficiency and overall profitability, Clothing generally is considered an expense item, but in reality its effect on the machines performance can make it an investment.

DATA FOR CALCULATING ECONOMICS OF MACHINE CLOTHING

As stated earlier the designed capacity of the machine is 331 metric tonnes per day of 52 gsm Newsprint at 100% efficiency. Since we are making only 48.8 gsm Newsprint on the machine, the design capacity would reduce to 310 metric tonnes per day running at the same operating speed of 650 meters per minute. Taking machine efficiency 86% and 6% finishing loss, the finished production would work out to 250 metric tonnes per day and taking 300 days of operating the annual production would work out to 75,000 metric tonnes.

1	Annual newsprint production	...	75,000 MT
2	Average production per day	...	250 ,,
3	Newsprint selling price	... Rs	7,000 per tonne
4	Variable cost for manufacturing Newsprint	... Rs	4,200 ,,
5	Specific steam consumption pertonne of water evaporated	...	1.5 T
6	Moisture in paper leaving press	...	57 %
7	Moisture in paper at reel	...	6 %
8	Cost of steam per tonne	... Rs	130
9	Cost of power per unit	... Rs	0.35
10	Cost of machine clothing per tonne of paper manufactured	... Rs	110 per tonne

11	Cost of high pressure shower pump, motor and installation	... Rs	8 lakhs
12	Cost of chemicals for continuous cleaning	... Rs	1,500 per day
13	Total number of hours for clothing replacement/annum	... Rs	240 Hrs.

Most of the time the clothing replacement is carried out in conjunction with a scheduled stop for cleaning, maintenance work, raw material shortage, power shortage etc. So the actual down time for clothing replacement is when an unscheduled stoppage is taken for replacement caused by deficient felt function. With the present clothing being used the unscheduled stoppage for clothing replacement is about 30% of the total replacement time. The felt is normally replaced during a scheduled stoppage if it is believed that it gives a negative effect on production during the period until the next scheduled stoppage.

During the last three months of running the Newsprint machine, the machine down time due to breaks/stoppage caused by inefficient cleaning of clothing, inefficient sheet/trim knock-off and deficient clothing performance is between 3 and 4%. This down time can be brought down by adopting better mechanical and chemical cleaning system and by using better quality machine clothing. When this down time is reduced the production is increased. Assuming that we save 2% to 3% down time by better runnability of machine, we produce additional newsprint of 5 to 7.5 MT per day. By reducing breaks on the machine we are reducing the total broke to be recycled. Recycle of broke involves reprocessing cost on machine. So the net cost of producing newsprint is reduced. by improving the runnability of machine apart from increasing the overall production.

Case 1:—Mechanical cleaning system

Cost of 2 high pressure cleaning shower flooding nip shower, edge shower, high pressure pump, motor and installation cost	— Rs	8 Lakhs
Cost of running the unit	— Rs	3.5 ,. per annum
Reduction in downtime due to better cleaning system	—	1%
Total increase in production per annum	—	750 MT
The contribution by this additional production (the sales realisation minus the variable cost)	— Rs	21 Lakhs

This shows that it is very profitable even if we achieve less than 0.5% reduction in down time by installing better cleaning system.

Case 2:—Chemical cleaning of felts:

At present we are loosing atleast one hour per week as downtime for shutdown Chemical cleaning of felts. Loss of production due to shut down cleaning of felts 500 MT.

By resorting to contnuous chemical cleaning atleast 50% of this down time can be avoided.

Extra production due to continuous chemical cleaning	...	250 Metric tonnes
Contribution	...	Rs. 7.5 Lakhs
Cost of continuous chemical cleaning	...	Rs. 1500 per day Rs. 4.5 lakhs per annum

By resorting to continuous chemical cleaning the down time for shutdown cleaning is reduced and also the life of felts is improved due to reduced clogging tendency of felts and the down time for unscheduled stoppage for felt replacement is reduced.

Case 3 : Improved runnability by better clothing performance

Cost of machine clothing per tonne	— Rs. 110/-
Let us say that we go for better quality of fabrics and better quality of felts paying an overall 20% excess	
Total excess amount for improved quality machine clothing	Rs. 16.5 lakhs p/ annum

This amount can be realised by achieving only 1% increase in production due to better quality and realiable machine clothing will reduce the unscheduled stoppage for clothing replacement atleast by 50%. Taking the present average of 72 hours unscheduled stoppage per annum, this can be brought down to atleast 36 hours. This means an extra production of 375 MT per annum or a contribution of Rs. 10.5 lakhs.

Here. I would like to add that on a machine there are few critical position where the quality of machine clothing effects the runnability of machine to the maximum extent. On our

machine the critical position are forming fabric, pickup felt and III press felt. The unscheduled stoppage which is about 72 hours per annum is mainly due to deficient clothing performance in these three position. These three clothing contribute to about 60-75% of the total machine clothing requirement per year. By concentrating on these three position and going in for improved quality of clothing the overall runnability of the machine can be improved.

Case 4 : Machine clothing v/s steam consumption

Specified steam consumption per tonne of water evaporated ... 1.5 tonnes

Let us say that one set of felts gives an average dryness of paper after pressing of 58% and another set of felts gives an average dryness of 57%. The saving in cost for one percent change in dryness is approximately Rs 10 per tonne of paper. So by increasing the dryness of paper by 1% we save around Rs 7.5 lakhs annually. The higher dryness of paper after pressing improves the runnability because of better strength of paper improves the moisture profile, and the drying capacity is increased. So, a marginal excess amount can be spent for better quality felts which has better water carrying and reduced rewetting characteristic, withstand high nip load for maximum water removal, keep clean and better dewatering characteristic at the uhle box.

As the machine approaches maximum productivity the importance of machine clothing performance as production and profit factor increases. Till recently since the downtime of machine was more due to various reasons, the cleaning of felts and fabrics, repair of felt and fabrics and clothing replacement were carried out mostly during stoppages for other reasons like equipment repair, shortage of pulp, steam, power, chemical, etc. The true down time required for felts and fabric cleaning and downtime due to deficient clothing performance is not reflected on the total monthly downtime analysis. So, the effect of clothing performance on production and profit margin cannot be felt till the machine approaches the standard.

Finally, I would like to comment that in the above for case where I have discussed the economics aspects of clothing, I have assumed most of the downtime which can be saved by better cleaning and better quality clothing. After the paper machine is run steadily for couple of years a detailed study of the factual results obtained with different types of cleaning and different qualities of clothing can be analysed from economic point of view. To deduce from results obtained from only two three clothing will lead to erronious results. The above cases can taken only as a guide to calculate the economic aspect. Though our newsprint machine was started in July 1981. the machine is run fairly continuous only from end of last year. Now that we are running the machine continuously we will be maintaining a detailed record of results obtained with different machine clothing reasons and total down time caused by clothing, the initial conditions of the clothing, the condition during running and final condition before removal, the seam consumption from start to the end of the felt life, the number of days the felt was on machine, the number of hours it was run and the production obtained and the reason for removal of the clothing. By assembling, charting and interpreting the data obtained from a number of clothing used, the economic performance of each type of clothing and the economics of the cleaning system can be analysed.