DEWATERING OF CANE DIFFUSER BAGASSE USING A SPIKEY-TOOTH PRESSURE FEEDER

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Abstract

A spikey-toothed roll pressure feeder was installed on a conventional three roller mill used to dewater bagasse from the cane diffuser at Amatikulu mill. This is a presentation of the results achieved by this dewatering unit. Comparisons are also drawn against a grooved two roller, pressure fed, three roller mill and a conventional four roller mill, both used in the same dewatering application.

Introduction

Amatikulu mill has a cane diffuser rated at 400 tons cane per hour (62 tons fibre per hour). Dewatering of the bagasse is done through three sets of drying mills, two of which have pressure feeders and the third has two conventional four roller mills in series. Of the two pressure fed mills, the first has a conventional two roller, Walker type, pressure feeder with grooved rollers, while the second has a two roll spikey-tooth pressure feeder.

Layout

Drive Arrangement

The spikey-tooth pressure feeder (STPF) is gear driven. Two straight spur gears are used, one on the final drive gear wheel shaft and the other on an independent shaft which is coupled to one of the spikey-tooth rolls.

Dewatering Unit Arrangement

The pressure feeder is mounted on its own headstock. The bagasse is fed into the spikey-tooth rolls via an adjustable chute, which is fed from an overhead slat carrier. A hinged plate makes adjustment of the chute possible. A pneumatically operated pinch plate allows the flow of bagasse to the spikey-tooth rolls to be stopped at any time. The spikey-tooth rolls feed the mill through a short, robust pressure chute.

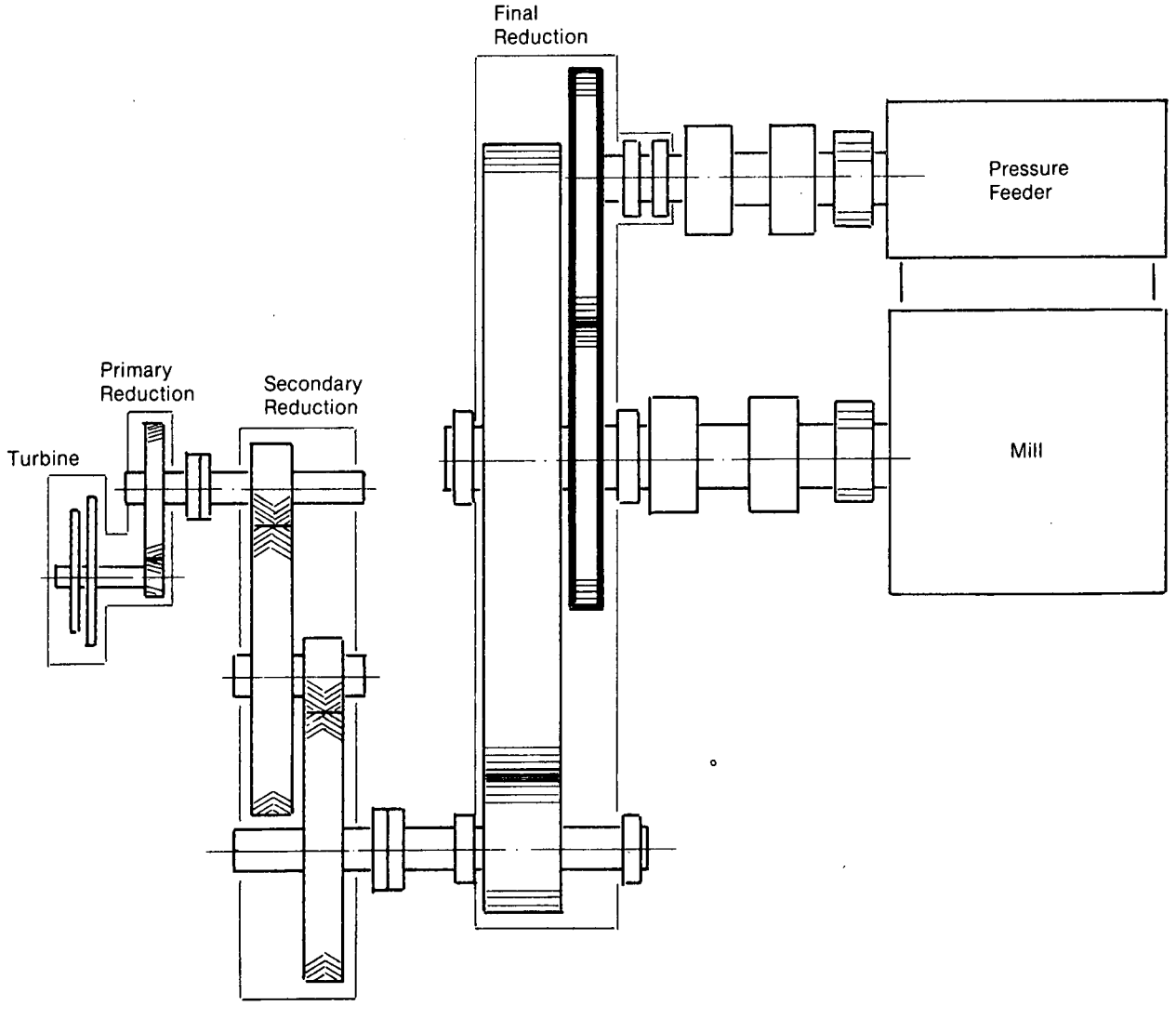

FIGURE 1 Mill drive arrangement

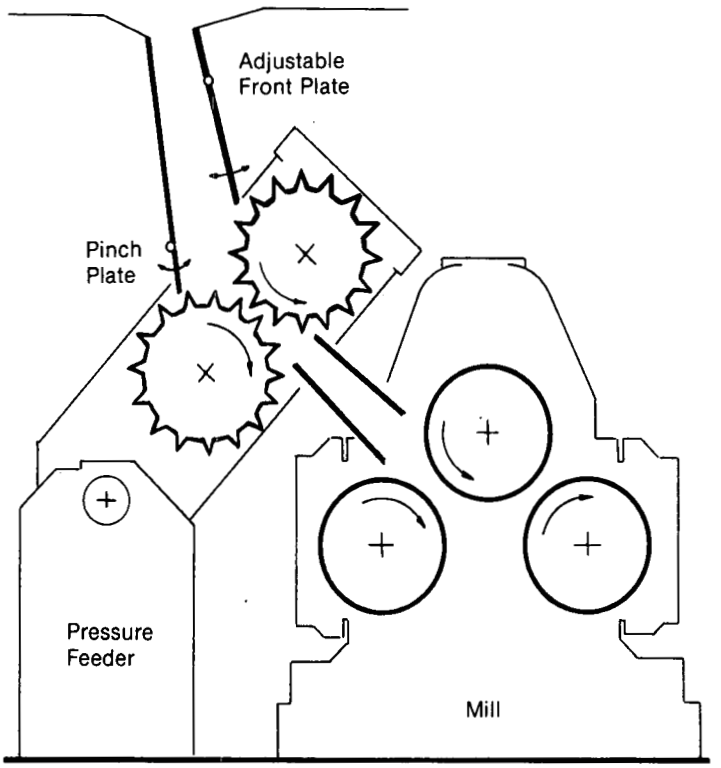

FIGURE 2 Dewatering unit arrangement

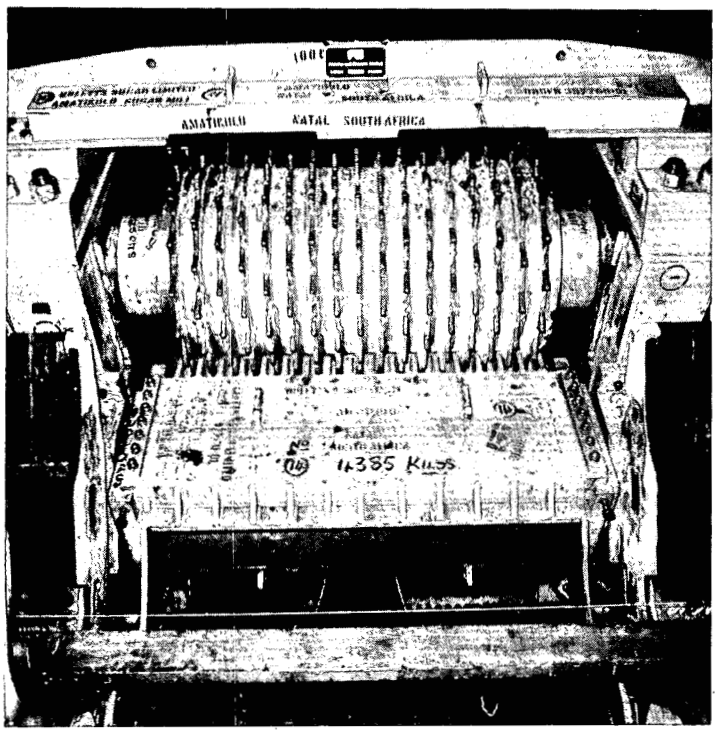

FIGURE 3 Photograph of STPF

Results and Discussion

Throughput

The existing feed arrangement, whereby an overhead slat conveyer is used to feed all three dewatering units, makes it very difficult to establish the split between the three units. If it is assumed, however, that the split is proportional to the escribed volumes of each of the mills then the spikey-tooth pressure fed mill handles 40% more than either of the other two units i.e. about 41% of the total bagasse throughput. The only reason for it being greater is the physical limitations on reducing the throughput of the spikey-tooth pressure feeder. Based on the average crushing rate of 50 tons fibre per hour for the 1983/84 season, No. 2 Dewatering Unit handled, on average, about 21 tons fibre per hour which is equivalent to about 130 tons cane per hour.

Mill Settings

The spikey-tooth dewatering mill was set up with a theoretical 2,9:1 work opening ratio. In practice however this turned out to be a 1,8:1 work opening ratio as the top roll lifted to its maximum of 32 mm. From week 16 the mill was set up using the recommended work opening setting of 1,7:1 and this gave the best results.

Bagasse Moistures

The bagasse moistures from the STPF dewatering unit varied from a high of 56,3% in the first week of operation to a low of 50,5%. See Table 1. The season average of 52,9% for the STPF dewatering unit was appreciably better than that for either of the other two dewatering units, being 0,5% better than that for the grooved roller pressure fed dewatering unit, and 1,4% better than that for the two mill dewatering unit. It is important to remember that the STPF mill was processing 40% more bagasse than either of the other two dewatering units.

TABLE 1

Bagasse Moistures — 1983/84

Week	Individual dewatering unit moistures (%)				Average crushing rate (TFPH)
	1	2*	3	Combined	
1	55,9	—	56,6	54,9	38
2	54,8	—	54,7	52,7	47
3	54,9	—	56,0	54,4	50
4	54,7	—	58,3	54,4	50
5	54,5	—	56,5	54,2	50
6	56,6	56,3	57,3	54,3	51
7	53,1	53,6	55,0	54,1	51
8	51,9	51,8	53,6	53,3	50
9	51,6	51,4	51,8	51,4	50
10	—	53,3	53,5	52,0	48
					Mid-Season Stop
11	—	53,4	54,7	51,5	38
12	-	56,2	56,2	53,4	48
13	53,3	55,2	55,1	51,5	45
14	53,3	51,9	50,3	51,9	51
15	52,3	51,3	54,6	52,8	49
16	52,8	54,4	52,1	53,8	57
17	—	54,1	55,0	52,5	52
18	54,0	52,8	53,5	52,1	49
19	53,1	51,7	55,6	52,7	56
20	53,3	52,2	54,3	52,6	55
21	54,0	52,9	56,9	52,2	52
22	53,5	53,9	53,1	52,3	57
23	54,6	50,5	55,4	52,9	55
24	51,9	51,5	56,8	52,4	54
25	52,3	53,1	53,4	53,6	46
26	54,6	52,8	53,9	53,1	49
27	54,5	52,8	54,0	52,7	40
28	51,9	52,4	53,2	52,0	51
Year To Date	53,4	52,9	54,3	53,0	50

* Spikey-toothed pressure feed unit.

If the average bagasse moisture for each of the dewatering units during the 7 week period from week 18 to week 24, (week ending 24.12.83) is calculated, then the results from the STPF are 1,3% better than those for the 1st Dewatering Unit and 2,9% better than those for the 3rd Dewatering Unit. This 7 week period is significant in that the optimum work opening ratio of 1,7:1 had only been implemented in week 16; all the plant was operating effectively; the cane supply was regular and the quality of the cane was reasonable. After Christmas the cane supply became erratic and the quality of the cane deteriorated markedly.

Power Absorbed

Torque measurements, using strain gauges and telemetery equipment, carried out on the tailbars of the pressure feeder and the mill, revealed a maximum power requirement of 86 kW for the pressure feeder and 328 kW for the mill, giving a total absorbed power of 414 kW. See Table 2.

TABLE 2

Mill Torque Measurements

Top roll speed	Torque		Power		
	Pressure feeder	Mill	Pressure feeder	Mill	PF % Total
rpm	kNm	kNm	kW	kW	%
1,45	212	1 106	47	179	20,94
1,45	220	1 240	49	201	19,70
1,81	224	1 068	63	216	22,49
1,81	256	1 145	72	232	23,67
1,81	277	1 335	78	270	22,30
1,81	212	1 240	59	251	19,11
2,41	195	954	73	257	22,09
3,02	183	973	86	328	20,68
				Average	21,37

From Table 2 it can be seen that the pressure feeder absorbs about 21% of the total power observed. This is much lower that the 30% which is generally accepted for grooved roller pressure feeders. The power absorbed by the STPF dewatering unit under normal operating conditions represents 10,8 kW/t fibre/h. The Australians with similar size mills quote between 6,5 and 8,5 kW/t fibre/h, while Fletcher & Stewart estimate 11 kW/t fibre/h.

Advantages

The spikey-tooth pressure feeder has several advantages over a grooved roller pressure feeder and these include-

- The STPF has a very positive feed into the mill which minimises slippage. Slippage absorbs power and increases wear.
- Less power is required to drive the STPF.
- The moistures from the STPF are much lower.
- The STPF rolls are robust and require little attention during operations. No welding is required to roughen the teeth.
- Less mechanical damage will result when tramp iron goes through the STPF because of the greater clearances. This means longer roll life.
- Any repairs to the teeth of the STPF can be undertaken at the mill. The STPF rolls do not have to be sent for reshelling.

Conclusions

From the results obtained we can see that spikey-tooth pressure feeders are particularly suitable for dewatering cane diffuser bagasse for the following reasons:

(1) Positive feeding characteristics
(2) Low power requirements
(3) Low bagasse moistures obtainable
(4) Good mechanical efficiency
(5) Minimal attention required

Optimum results are achieved when a mill work opening ratio of 1,7:1 is used. The spikey-tooth pressure feeder appears to be capable of handling very large quantities of bagasse. Any restriction on throughput would be related to the mill rather than to the pressure feeder.

Acknowledgements

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APPENDIX

Technical Details	
Gearing	
Type	Straight spur
Wear life	50 000 h
Design torque	678 kNm
Pressure Feeder	
Mass of Spikey-Tooth roll	12,4 t
Drum diameter	1 016 mm
Length of PF chute	1 310 mm
Mass of PF chute	4,4 t
Setting (drum to drum)	178 mm
Mill	
Roller length	2 134 mm
Roller diameter	1 168 mm
Cost	
Pressure feeder	R420 000
Gearing	265 000
Erection	80 000
Total Cost	R765 000
Length of Project	
Pressure feeder delivery	8 months ex F & S
Gear delivery	9 months ex Vecor
Erection	3 months