BAGASSE AVALANCHE SCREWS AT AMATIKULU

By J. R. JACKSON
Tongaat-Hulett Sugar Limited, Amatikulu Mill

Abstract
The installation and operation of a pair of avalanche screws to improve the retrieval of bagasse from the bagasse storage shed at Amatikulu, is discussed.

Introduction
Most sugar mills have experienced some avalanche problems when endeavouring to reclaim too large a quantity of bagasse from the top of a relatively high stockpile. Many methods of counteracting this problem have been put into practice by engineers throughout the industry and one of these involves the use of avalanche screws.

Avalanche screws are relatively new to the SA sugar industry and originate in Australia where they are used in rectangular stores similar to those in this country. In 1980, personnel from Tongaat Sugar Ltd visited overseas countries and thereafter decided to design, build and install similar screws for their mill. The success of these screws resulted in the installation of similar screws at Amatikulu during the 1982/83 offcrop and at the Felixton II mill in 1983.

Description of Plant
The plant consists of two identical screws suspended from each side of the bagasse crane. Each screw is attached to the crane by means of three 100 mm pipe ties which are rigidly fixed to the support truss at the lower end and pivoted at the uppermost end enabling the screw to swing in one direction only (i.e. at 90° to the scratcher).

The screws are each supported by four bearings and are driven by an electric motor through a reduction gearbox both of which are mounted at the uppermost end of the screw.

The screws move with the bagasse crane as it traverses the shed and are fixed in position relative to the crane. The scratcher operates between the two screws and may be raised or lowered in relation to the ground and to the screws.

The general layout of the plant are shown in Figures 1 and 2.

Installation of Plant
During the offcrop of 1982/83, major changes were made to the bagasse shed. The shed was increased from a capacity of approximately 500 to 1 000 tons by the addition of three new bays. The reclaim conveyor was changed from a slat carrier to a 2 100 mm wide belt and the rest of the plant was extended to accommodate the extensions. At the same time, only the No. 1 avalanche screw was installed because of the lack of capital at the time of the extension.

FIGURE 1 Layout of 1 000 ton bagasse shed at Amatikulu
This plant was successfully commissioned at the beginning of the 1982/83 season and operated for 10 weeks. The Amatikulu mill was then stopped for 10 weeks in the middle of the season because of the effects of the drought. During this period, the No. 2 avalanche screw was installed at a cost of R9 000. The specifications of the screws are shown in Table 1.

**TABLE 1**

<table>
<thead>
<tr>
<th>Screw-pitch</th>
<th>600 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-diameter</td>
<td>600 mm</td>
</tr>
<tr>
<td>-length</td>
<td>3 000 mm</td>
</tr>
<tr>
<td>-speed</td>
<td>100 rpm</td>
</tr>
<tr>
<td>No. screw sections</td>
<td>6</td>
</tr>
<tr>
<td>Bearings: cooper split plummer blocks</td>
<td>2 X Inners</td>
</tr>
<tr>
<td>Motor power</td>
<td>2.2 kW</td>
</tr>
<tr>
<td>Motor speed</td>
<td>1 450 rpm</td>
</tr>
<tr>
<td>Angle of inclination</td>
<td>47°</td>
</tr>
<tr>
<td>Mass/screw unit</td>
<td>1 050 kg</td>
</tr>
<tr>
<td>Angle repose AK bagasse</td>
<td>51°</td>
</tr>
</tbody>
</table>

**Purpose and Operation of Avalanche Screws**

The primary function of avalanche screws is to eliminate untimely avalanches of bagasse and subsequent loss in time due to the stoppages. These screws are designed to sweep continually the face of the bagasse pile and maintain an angle of the face which is marginally less than the angle of repose of the bagasse.

Two screws are required, one for each direction of traverse. While the bagasse crane moves in the same direction as the reclaim conveyor the No. 2 screw does the work, but when the bagasse crane moves in the opposite direction to the reclaim conveyor the No. 1 screw does the work (See Figure 1).

The continual movement of the screws down the bagasse face appears to turn the bagasse fibres and position them so that they point in the same direction as the screw is travelling and in the same position relative to each other. The effect of this is a slippery face which enables the material scratched off the top of the pile, to cascade easily down the face to the reclaim conveyor. The long fibre diffuser bagasse is more prone to this than is the shorter fibre mill tandem bagasse.

Irrespective of the volume of bagasse which is scratched, a certain amount of material always remains on the face of the pile, waiting to be swept down the face to the reclaim conveyor.

**Tuning for Maximum Performance**

The No. 1 screw was initially installed at an angle (θ) of 52° to the horizontal (see Figure 2). In this position, the screw's operation was satisfactory but at times, there were areas on the face which it did not sweep.

At this time, there were two schools of thought; one was that the angle of the screw should be increased to 60°, because the volume of the storage shed had been reduced and the other was that the angle be reduced to 47° to ensure that the whole face of the pile was swept by the screw.

The angle was increased to 60° but proved to be unsatisfactory as the screw was now at an angle greater than the angle of repose and a mean value for this was found to be 51°. After a week the screw angle was changed to 47° and the results of this alteration were very successful. At this angle, the whole area of the face was swept by the screw and the stability of the pile was maintained.

When only the No. 1 screw was operating, the face of the bagasse was not being swept whilst the bagasse crane was moving in the same direction as the reclaim conveyor, which resulted in an overload situation for this one screw on the return traverse. To cater for this load, it was essential for the operator to travel very slowly to prevent the screw from biting into the pile and the reaction force pushing it away from the pile and provoking it to swing perpendicular to the reclaim conveyor. At this point, it was essential for the operator to reduce or stop the reclamaton of bagasse and to allow the screw to settle.
The installation of the No. 2 screw also at an angle of 47° eliminated the overloading problems in the one direction. The system has been in operation for five months with no mechanical problems or avalanches.

Minor problems experienced with the No. 1 screw were that the support frame was not rigid enough and that the spool pieces on which the Cooper Split bearings were mounted, were too short. The second screw was modified and the above problems were eliminated.

**Advantages and disadvantages of screws**

The advantages of this plant at Amatikulu are that avalanches no longer occur, the feed of bagasse is steady, maintenance is low, the initial cost was relatively low and that the shed and bagasse pile is neat. The disadvantages on the other hand are that the screw cannot cope with excessive feed, it adds weight to the crane, it is another item to maintain and the capacity of the shed is reduced marginally.

**Conclusion**

The installation of the avalanche screw has proved to be successful and trouble free during its first season of operation at Amatikulu and its use in any mill where avalanching is a problem is recommended.

**Acknowledgements**

Sincere thanks to M. Greenfield and M. Crossman who witnessed the operation of bagasse screws in Australia and pioneered it at the Maidstone Mill. Thanks to Tongaat-Hulett Technical Management Department staff who handled the installation at Amatikulu mill and sincere thanks to the management at Amatikulu mill for their support and their permission to present this paper.