A DESCRIPTION OF THE CONVEYOR BELT INSTALLATION AT UMFOLOZI MILL

By G. G. ASHE

This paper is not intended to be a technical one, but more of a descriptive nature.

In these days of rising costs and labour shortage, cheap labour that is, one has had to study each department to see if the jobs that are being done manually could be substituted by the implementation of automatics, instruments or mechanical handling.

Instruments and Automatics have already made their appearance in the sugar industry in Natal and have been a great success, but this is a subject on its own and will not be covered in this paper.

Mechanical handling of materials is nothing new, and through the years the methods employed have been improved upon from time to time and one of the methods being widely used these days is the rubber conveyor belt.

In modern sugar mills you will find carriers for cane, inter-carriers, bagasse, bagacillo, ash, coal, mud, sugar and bags, all being converted to endless rubber converyor belts.

In the Umfolozi Co-operative Planters Limited factory at Riverview there is a total of 5,181 feet of rubber belt conveyors installed.

Bagasse Carriers

The bagasse is carried from the 84″ mill on a 36″ wide belt running at 350 feet per minute and this handles 46 tons of bagasse an hour. This bagasse, together with the bagasse from the 66″ mill are fed on to a 42″ wide conveyor running at 350 feet per minute and running up at an angle of 20° and handling 66 tons of bagasse per hour. This belt discharges on to a chain and slat conveyor which feeds the individual boilers, the excess bagasse discharges from the slat conveyor on to a 24″ wide belt conveyor, which carries the excess bagasse out of the boiler house on to a dump.

When there is a shortage of bagasse for any particular reason the excess bagasse on the dump is shovelled on to a 24″ wide conveyor belt, which runs underground under the dump, and this is conveyed back into the factory and on to the 36″ wide belt coming from the 84″ mill, and is fed to the boilers on the normal system of conveyors.

An added feature on this system is the installation of a photo-electric cell across the 36″ wide conveyor and immediately this belt should run empty due to a mill stoppage, a relay is started and the coal feeders on the boilers, fitted with Spreader-Stokers, are started automatically and coal is fired into the furnaces before the supply of bagasse to the boilers is finished. On the resumption of supply, the coal feeders are stopped automatically. There is a time lag before the starting and stopping of coal feeders. An alarm is also sounded.

Bagasse is then fed to the boilers which are not fitted with spreaders, by means of the return belt from the stock pile.

Bagacillo Conveyor

The collection of bagacillo is done by means of wire mesh screens placed in the chutes feeding the furnaces; the bagacillo so collected falls on to a 14″ wide conveyor belt running at 370 feet per minute; this belt discharges the bagacillo into a chute feeding the mud mixer.

Mud Conveyors

The filter station has five vacuum filters and these discharge the mud or cake on to a short cross conveyor 14″ wide. These in turn discharge on to a wide collecting belt running at 250 feet per minute. This discharges on to another conveyor which runs through the factory and is 14″ wide and runs at 312 feet per minute, discharging on to a conveyor 1,440 feet long, the last 700 feet being 25 feet above the ground, and along this length the mud is ploughed off on to the ground below, forming a pyramid-shaped dump. This belt runs at 410 feet per minute and during the flood periods approximately 20–22 tons of mud is conveyed per hour. A second branch conveyor 40 feet high is at present being constructed to help handle the season's collection of mud, as very little of the mud produced is carted away during the season.

Coal Conveyors

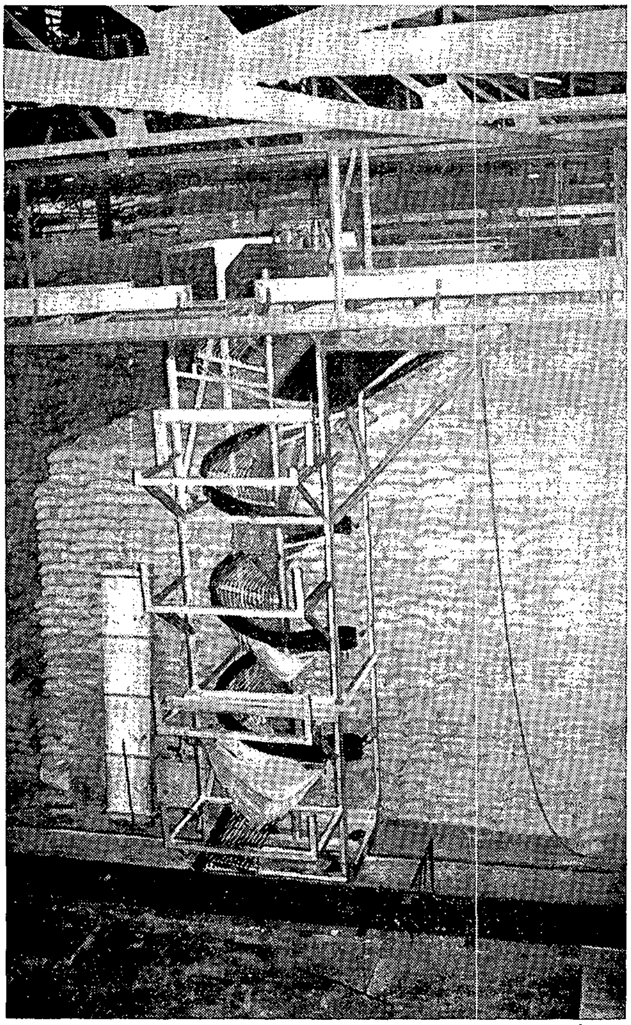
The boilers fitted with spreader stokers are also provided with coal feeders and these feeders are supplied by a system of coal conveyors 14″ wide and running at 270 feet per minute. This belt is fed from a coal storage bin and can handle up to 40 tons per hour.

Bag Conveyors

The handling of bagged sugar has been completely mechanised and no bag is lifted higher than two feet or carried further than 10 yards, and this is only done by the stackers. As Umfolozi is a Refinery there are no less than five types of packages to be handled, namely Refined in 100-lb. pockets, 50-lb. paper sacks, and 48-lb. cartons; Mill White in 100-lb. pockets and 50-lb. paper sacks; Brown Sugar in 210-lb. and 100-lb. bags. During the past season there were times when all five packages were being conveyed at the same time.

In the bagging store the bags are fed on to the main 36″ wide rubber conveyor, running at 150 feet per minute, by short slat conveyors which are controlled by an operator who keeps the main belt filled with bags by stopping and starting the slat feeder conveyors from a central control panel.

The main sugar store is some little distance from the factory and the bags are conveyed via an inclined covered belt which has to cross several train tracks before it enters the main sugar store just under the roof trusses in the one corner of the building.

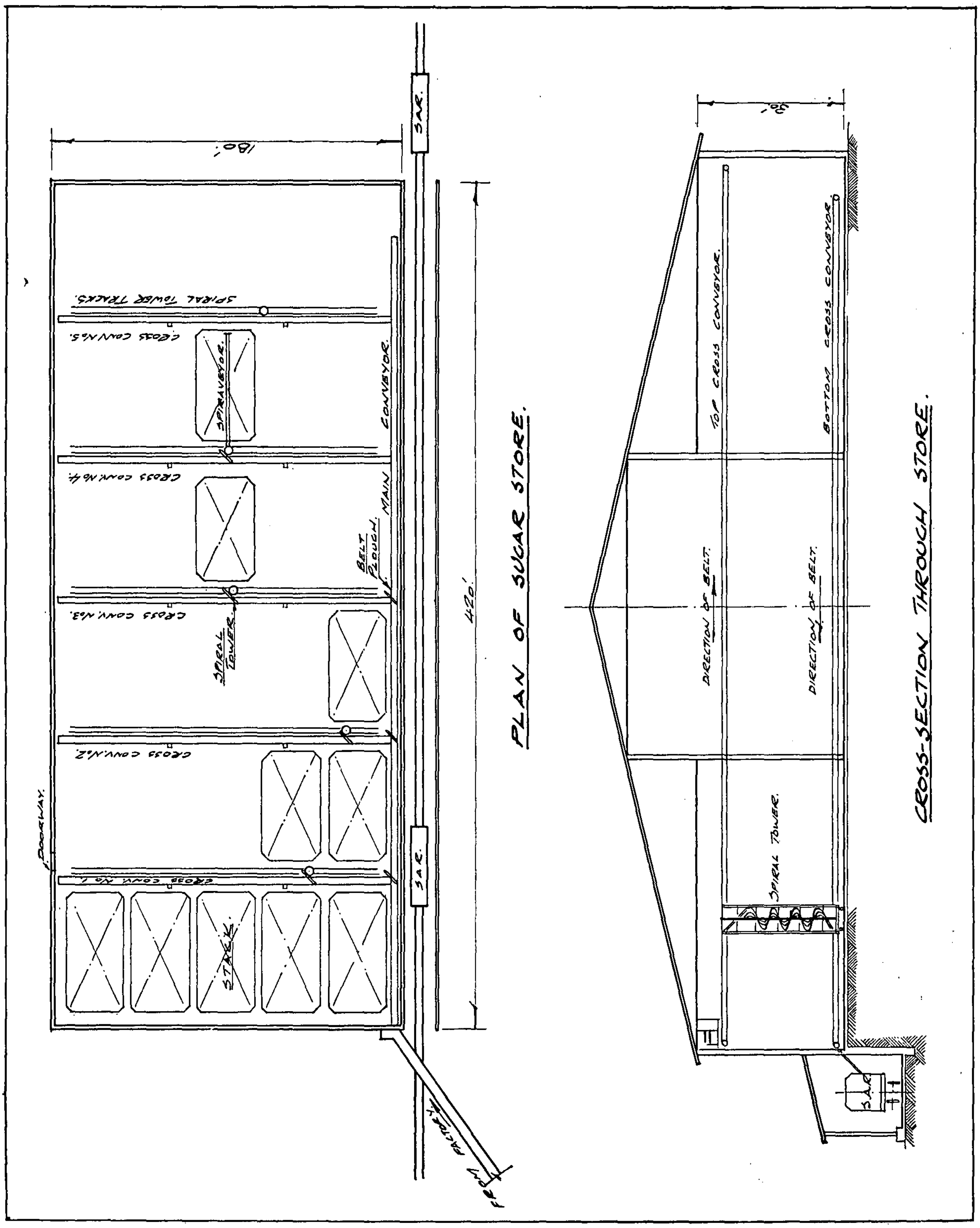


The sugar store is 420 feet long by 180 feet wide and 30 feet from floor to underside of roof trusses. The inclined belt discharges the bags on to a 36″ wide belt which runs along the 420 feet side of the store at a height of 28 feet. There are five 36″ wide conveyors running at right angles to this long conveyor and they are spaced at 70 feet centres and are 26 feet above the floor. The general layout of the conveyors in the store is shown in Figure 1.

At eacb transfer point along the long conveyor is fitted a mechanical plough. This plough is nothing else but a vertically mounted conveyor belt with rubber strips bolted to the belt. This plough can be swung into position rapidly by means of an air-operated cylinder. When ploughing, it is at an angle of about 40° to the main belt. The vertical belt runs at about 300 feet per minute. When not in operation the plough is lying parallel with the main belt and bags continue on to the next plough point. When these bags get onto the cross conveyor they can be taken off at one of five discharge points along the length of the cross conveyor. Here again the bag is ploughed off with a vertically-driven belt, but this plough is mounted on top of a steel tower which is mounted on tram wheels and runs on rails parallel with the cross conveyor. This tower, which is six feet square, has a spiral at 4′ 6″ pitch consisting of $\frac{3}{4}$″ diameter rods at $1\frac{1}{2}$″ centres, and $\frac{1}{8}$″ mild steel plate 6″ high is welded round the edge of the spiral to prevent the bags from falling off. One of these towers can be seen in the picture. On two sides of the tower there is a steel framework for supporting a platform.

The bags are ploughed off the cross conveyor down a chute, which is attached to the tower, and on to the spiral rods, they then gravitate to the bottom where they are ploughed off by means of a round bar chute and this chute drops the bag on to a spiraveyor, which runs at right angles to the cross conveyor and tower, on the floor. The spiraveyor runs as far as the next cross conveyor. The stacking boys take the bags off the spiraveyor and stack them on the floor equidistant on each side of the spiraveyor. As the stack grows in height the spiraveyor, which has universal joints, is merely lifted on to the next row of bags and rests on top of the bags. After several rows the platform on the side of the tower is raised to the next level together with the motor of the spiraveyor, and the round bar chute is moved up one turn of the spiral. The bags are then stacked for several more rows, when the platform is moved up again, and so on until the stack is up to the underside of the roof trusses.

The mechanical plough is swung out of the cross conveyor and the whole tower is moved to the next position and is ready to start a new stack. Directly below the five top cross conveyors there are five 36″ wide conveyors on the ground. These run in


PLAN OF SUGAR STORE.
180'
420'
S.A.R.
S.A.R.
SPIRAL TOWER TRACKS.
CROSS CONV. No.5.
SPIRAVEYOR.
CROSS CONV. No.4.
CROSS CONV. No.3.
CROSS CONV. No.2.
CROSS CONV. No.1.
SPIRAL TOWER.
BELT PLOUGH.
MAIN CONVEYOR.
DOORWAY.
STACK.
FROM FACTORY.
CROSS-SECTION THROUGH STORE.
30'
TOP CROSS CONVEYOR.
BOTTOM CROSS CONVEYOR.
DIRECTION OF BELT.
DIRECTION OF BELT.
SPIRAL TOWER.
S.A.R.

the reverse direction to the top conveyors and the drive end of these conveyors discharges through a small hole in the wall on to a short chute which discharges into an S.A.R. truck standing in a covered siding. The rail level is 12 feet below the floor level of the sugar store.

When bags are being loaded directly into S.A.R. trucks and are not being stacked, the bags travel right to the bottom of the spiral tower and discharge directly on to the belt conveyor at the bottom. The bags travel along this belt directly into the S.A.R. truck and are only handled by the boys stacking in the truck itself. When a truck has to be loaded from a stack, the spiraveyor is placed on top of the stack and this time the motor is on top of the stack and the spiraveyor discharges into the spiral tower. The bag then travels to the bottom on to the belt conveyor below, and into the truck.

Flap gates with counters on are mounted on all conveyors to count the number of bags as they are conveyed along.

From the above it will be seen that a lot of conveying is done at Umfolozi and a lot of experience, some hard-earned, has been gained on belt conveyors.

Some of the advantages of belt conveyors are:

1. Low horse power compared to slat and other conveyors.
2. Properly trained belts can last many years in comparison to chains.
3. Maintenance is low.

The primary aim when designing, operating and maintaining a conveyor is to increase the life of the belting used on the conveyor as this represents from 40 to 60 per cent of the total cost of the conveyor. A point to remember is that a conveyor can be constructed from almost any kind of equipment and although they are abused and neglected, they will still continue to run over idlers that have not turned for years and are buried in the material it is supposed to carry, with resultant damage to the surface and edges of the belt, also overloading of the driving motor and tensioning the belt beyond the tension it is designed for. If a belt is mis-aligned it can cut its way through wood or even the steel framework of the conveyor and the belt will still go on running during the process and at the same time destroy the edges of the belt.

If a belt is treated properly it will respond with years of increased life and service.

The author wishes to thank the Umfolozi Co-operative Sugar Planters Limited for permission and co-operation in presenting this paper.

The President commented that Mr. Ashe had mentioned a belt conveyor system being changed to a slat-conveyor system. He thought this a retrograde step as bagasse could be conveyed very easily by a belt conveyor at about one third of the H.P. required for slat conveyors. One disadvantage was that the belt conveyor system was not as clean as the slat conveyor. He noticed that the bagacillo conveyor was running at 310 ft. per minute and he asked if any precautions were made to avoid windage. Mr. Ashe did not mention if the belt used for conveying filter mud was the ordinary standard design or if special material were used. He asked how high the bags of sugar in the store were stacked, how many bags were stacked above each other and if he had any trouble with the breaking of bags.

Mr. Ashe replied that a slat conveyor was not put in to replace a conveyor belt. This slat conveyor had always been there. The rubber belt was installed so that surplus bagasse could be stored to feed back when necessary on to the main bagasse carriers. It was found that loading of bagasse on to the conveyor in front of the boilers was never used. The inclined belt conveyor now discharges directly on to the slat conveyor. The bagacillo conveyor belt operates in a light metal cover, the belt being completely enclosed, and the only windage would be caused by the belt itself. When mud conveyors were first installed at Z.S.M. just ordinary belting was used but this ran for about 5 years without any trouble. It was then replaced by another ordinary belt but this began to give trouble because it was being bent in one way all the time. Oil resisting belts were then used but they also suffered from the same thing. At Umfolozi ordinary belts were put on; they ran for about three years and when they wore out they were replaced by ordinary belting again. Periodically these belts had to be turned over. The present belting was oil resisting and had given no further trouble.

Mr. Munro said that the oil resisting belt now installed had not been entirely successful. After this had been replaced recently by a more suitable belt this had run for two or three months without any further trouble. Time would tell whether it could last better than the standard belt.

Mr. Ashe, in reply to the President, said that stacking of sugar bags started off at stacking to about 25 ft. high. Because of the shortage of S.A.R. trucks they were made up to 30 ft. high and had no trouble at all with bags bursting. He had seen very much higher stacking than this elsewhere without trouble due to bags bursting. This applied to new bags, but probably trouble would rise with second-hand bags.

Mr. Hulett said that he was interested in the surplus bagasse storage arrangement and wanted to know if the bagasse was stored in the open or in a shed and roughly how many boys were required to feed the mill from the dump.

Mr. Ashe said the bagasse was now stored in an area with walls but no roof. When there was a long mill stop all the boys from the carrier went along to the dump and they fed the excess bagasse back into the system. A quantity of bagasse was required when the mill was stopped, but not as much when the mill was crushing. He said that about 18 boys went out on to the dump to feed the boilers with bagasse.

Mr. Munro pointed out that bagasse was not the only fuel relied upon during the mill stoppage. Some boilers were fed by coal. In the case of mill stoppage coal was first of all used. Bagasse was however required from the dump for the B. & W. boiler furnaces.

Mr. Davies said that he had seen belting such as that described running at Mhlume, and while he was impressed by the cleanliness of this system he was told that the cost was more or less the same as slat conveyors. When a belt conveyor was installed at Felixton to handle mud there seemed very little wear.

Mr. Ashe said that once the edge of the mud conveyor belt was rubbed off the belt seemed to deteriorate very quickly. It was essential that it should be kept strictly in alignment.

Mr. Rault inquired how much mud per cent cane was handled. Could it ever rise as high as 10 per cent on cane under the usual conditions of sulphitation or defecation?

Mr. Ashe said that at Umfolozi after floods the mud lying underneath the mill had to be shovelled out by labourers so at times it was probably more than 10 per cent.

The President asked, on the question of aligning belts if in the sugar store the action of ploughers did not tend to shift the belt over and if he used any self aligning guide pulleys to prevent the belt from running out of line.

Mr. Ashe said that when they first started the conveyor belt to the sugar store they had no self aligning idlers, but he had used these idlers at 2 ft. centres. At the plow points the bags tended to move the belt over about an inch, but immediately the bags were removed the belt went back straight away. There was nothing at that point to cut the sides of the belt. At Umfolozi no aligning idlers were now used in the conveying of sugar bags. He said that the stacking towers illustrated were most easily handled, as being mounted on wheels, they could be shifted from point to point very easily.