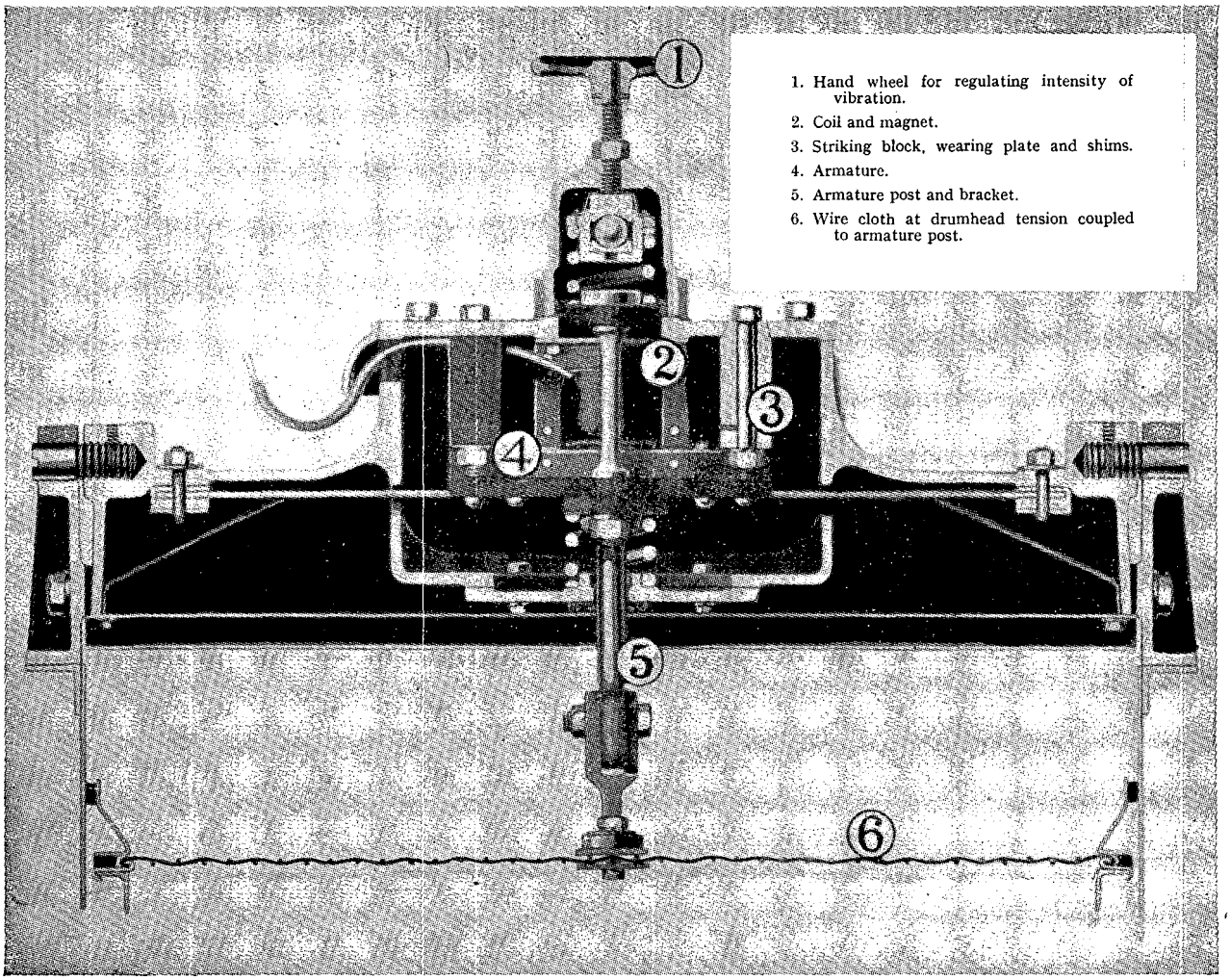
MIXED JUICE SCREENING AT DOORNKOP

By V. S. WINTERTON

The mixed juice from the mills is first screened through a cush cush screen (35 sq. ft. with $169 \times \frac{1}{32}''$ and $81 \times \frac{1}{16}''$ round punched holes to the square inch) and the fine bagasse particles are removed afterwards by means of Hummer juice screens.

Although our method of treating mixed juice is quite conventional, the Hummer type of juice screen is still fairly new to this country and some remarks on our experience with this type of screen may be of interest.

The Hummer screen differs from the types of screen more usually encountered in that vibration is confined to the screening surface only. The vibrator has two major assemblies, the magnet and the armature. The armature is "floating" but positioned in relation to the magnet by means of two counteracting coil springs and a steel guide strip. The magnet receives electric impulses of a fixed frequency and alternatively attracts and releases the armature. When attracted by the powerful magnetic field the armature snaps upward until the motion is stopped by metal to metal contact of the armature striking plates and stationary wearing plates mounted on the vibrator head. A "U" shaped push bracket transmits the force of the upper spring to the armature, returning to its lower position. The gap between the upper and lower positions determines the amplitude or stroke of vibration, which can be adjusted by a hand-wheel on top of the vibrator. The armature post, which is coupled to the armature, carries the vibration through the screen bracket to the vibrating strips which hold the wire screen cloth.



Cross section of Hummer Vibrator

The vibrations resulting from the up and down movement of the armature are in the vertical plane only and unlike vibrations produced by eccentric circular motion, there is no tendency for the screen to act as a conveyor. It is hence necessary to rely on gravity for the discharge of solids from the screen and for this reason the screen has to be mounted at an angle of about 30° to the horizontal.

Placing a screening surface at an angle reduces the effective diameter of the screening aperture, and hence the capacity of the screen. Particularly with very fine screens, where the diameter of the aperture is only slightly larger than the diameter of the wire, a 30° angle will reduce the effective screening area to about 70 per cent of the actual open area. [Apparent aperture = (0.866 × width opening) — (0.134 × diameter of wire) at 30°].

To overcome this decreased capacity effect, without the risk of reduced screening efficiency associated with a larger aperture, the manufacturers have designed a special feed box from which the juice should spray on the screen at right angles to it. This pressure feed box, fitted with tapered holes in the bottom, covers the first half of the screening area, the latter half of the screen acting as drainage area on which the separated bagacillo is allowed to drain.

The first Hummer screen 5 ft. by 4 ft. was supplied with a 60 × 40 mesh woven screen 0.009″ wire thickness and without the pressure feed box. The 60 × 40 mesh screen was chosen merely because our existing horizontal screen was equipped with such a screen. The feed to the screen was by means of a weir covering the full width of the screen.

As could have been expected for the reasons outlined above, the capacity of the Hummer screen was far below that expected, although the screening efficiency, judged qualitatively, was greatly superior to the old horizontal screen, equipped with an identical screen.

In an effort to increase the capacity of the screen, we made up a feed box to the manufacturers design, containing 84 holes tapered from $\frac{1}{4}$″ to $1\frac{3}{4}$″. The capacity of this feed box by far exceeded the capacity of the screen and even after blocking half the number of holes the screen capacity was still no larger than when using the weir type of feeder, which was not surprising as the pressure jet feeder box was unable to give jets of juice and resulted in a less efficient feed than the weir feeder.

The next step to increase the capacity of the screen was to fit a 40 × 40 mesh screen with 0.0076″ wire thickness. The weir juice feeder was put back as it was felt that the jet feed box would have to be completely rebuilt to reduce its capacity within the range of the capacity of the screen. The capacity of the screen improved to about $1\frac{1}{4}$ to 2 tons juice per sq. ft. screen area per hour, without impaired screening efficiency.

At this stage a second Hummer screen was obtained to which a 30 × 30 mesh screen was fitted with 0.0076″ wire thickness. With this type of screen the capacity of the screen improved to $2\frac{1}{2}$ to 3 tons juice per sq. ft. screen area per hour using the weir juice feeder, at the expense of a very slight reduction in screening efficiency. With the 30 × 30 mesh screen the mixed juice sent to process contains less than 100 p.p.m. bagacillo, determined by filtration through a filter paper. We are satisfied with the screen capacity at this efficiency and do not propose to experiment further with the jet feed box as we suspect, from theoretical consideration, that any increased capacity which may be achieved will be at the expense of screening efficiency.

Comparing the Hummer screen with the horizontal screen previously used by us, we found the following points in favour of the Hummer screen:

1. The life of a screen by far exceeds that of those used on the horizontal screen.
2. Due to the inclined position of the screens, steam cleaning can be carried out much more effectively.
3. The whole vibration mechanism is completely enclosed, needs no lubrication and can be easily adjusted to suit various conditions whilst the screen is in operation.

The only disadvantage of the Hummer screen is its somewhat noisy method of operation.

The President (in the Chair) asked Mr. Carter to give more details about the quantity of juice being screened.

Mr. Carter replied that they started off with the 60 x 40 mesh, which choked up very quickly and they could pass not even 30 tons of juice per hour through the screen. When they went to 30 x 30 mesh they could take 55/60 tons of juice per hour.

Mr. Thumann asked if there was any truth in the statement that the screening was more efficient near the vibrating element and that further away it was not so effective.

Mr. Carter pointed out that the screen vibrated over its entire area. As mentioned in the paper most of the bagacillo was removed in the first foot or so of the screen. There was a centre strip down the middle of the screen which tended to throw the juice out towards the side. A baffle was therefore placed in the middle of the screen to avoid splashing.

Mr. Elysee asked how many machines were required to operate with at 50 to 60 tons of juice per hour.

Mr. Carter replied they had two machines which could be changed over every four hours.

Mr. Elysee said that the Peck strainer appeared to be a very dirty element in the factory, but it was a very efficient strainer as determined by taking a sample of juice after passing through the screen and then this was passed through an 80 mesh screen, and the total amount measured by filtration through paper. When a reduction was made from 180 mesh down to 80 mesh there was a definite increase in the amount of bagacillo passed. The present strainer used at Amatikulu was not nearly as efficient as the Peck strainer, although it looks much cleaner. He asked if tests had been carried out on the various mesh sizes and he wanted to know how much more bagacillo was now passed through the bigger mesh screen.

Mr. Carter said that as the screen was inclined at an angle of 30° the full apperture was not available so that not so very much bagacillo could be passed through as might be expected.

Mr. Ross said that he had used three Link Belt strainers in tandem, and that a Russell Separator had been installed for experimental purposes. This separator proved unsuccessful on mixed juice but was installed in the supply line from the supply tanks to the vacuum pans. It was surprising the amount of fine bagacillo which was removed by this Russell separator. It had quite often been found that sugars deteriorated in polarisation after lying in the warehouse for some months and it was highly probable that this was due to the amount of fines which were passing to the boiling house.

Mr. Carter asked if it was possible that some of the bagacillo could not have been returned from the filters.

Mr. Alexander asked if the amount quoted of 100 parts per million of bagacillo collected on the filter was the total amount of total insoluble matter.

Dr. Douwes-Dekker said it was true that if bagacillo was left in the juice the sugar deteriorated quicker. He recalled a discussion with John Payne in Hawaii about the use of vibrating screens on clarified juice. Mr. Payne's reply was that if bagacillo was left in the juice this meant that the sugar became more hygroscopic and deteriorated quickly.

Mr. Elysee said he did not know if it was due to the Link Belt system used, but in recent years he had found large quantities of sand collecting in the bottom of tanks. He wondered if something similar had been found at Doornkop using the Hummer screen.

Mr. Carter said that owing to the arrangements of the factory he could not say if this was the case or not.

The Chairman (Mr. Bentley) said that in his experience vibrating screens, especially Link Belts, removed quite a lot of bagacillo but do not seem to take out much of the sand in the juice.

Dr. Douwes-Dekker said he had done some work on Hydro-cyclones to see if they could be more efficient than vibrating screens, especially as regards the removal of sand. He found that in the juice which came from the Link Belt screens there was not very much sand. Similar tests were carried out at Glendale where again it appeared that a considerable amount of sand was removed by the Link Belt screen.

Mr. van Hengel bore out what Dr. Douwes-Dekker had said, saying that a considerable amount of sand was trapped in the bagacillo removed by the vibrating screen.

Mr. D. J. L. Hulett asked if the Hummer screen lasted longer than the Link Belt or other type of vibrating screens and he therefore enquired how long the screens lasted—whether one, two or three screens were used per season.

Mr. Carter replied that the original screens were still in use and he imagined they would last for a very long time.

Mr. Thumann asked if a different angle had been considered as compared with a 33° angle, which was the inclination applied to new sugar screens now being installed at Umfolosi.

Mr. Carter replied that if one did not use a steep angle one would not be able to get rid of the bagacillo. As yet no other angle had been tried.

Mr. Keus said that tests had shown that the 30° angle was most suitable. He quoted figures about the solids left after passing through the Hummer screen. Analyses of the Cuban juices showed that 66 per cent of the solids (bagacillo) were retained on a 50 mesh testing sieve and, therefore, the use of 40 or 50 mesh screens on the Hummer removed the greatest percentage of the objectionable fibre while maintaining satisfactory capacities. Screening raw juices at finer meshes such as 80 or 100, would not recover sufficient additional solids to compensate for greater cost of installation and operation, shorter screen life and greater tendency of the finer meshes to clog with gum. The percentage by weight of washed and dried bagacillo in the screened juices from this mill, showed that screening at 40 mesh removed 49 per cent of the solids and that screening at 80 mesh removed 80 per cent of the solids. In Australia, the amount of solids removed was as follows: At 40 mesh—80 per

cent removed, 50 mesh—86 per cent removed, 60 mesh—94 per cent removed. The juices sent to the screens in Australia contained very much more solids than that at the Cuban mills which had already been passed through a coarse screen.

Mr. Rault said that our attitude to the action of bagacillo, in its bad effects on juice clarification, seemed very illogical. After having gone to the trouble of screening and successfully reducing bagacillo content in mixed juice down to 100 ppm., at a later stage when working the Oliver filters, we close our eyes to the fact that we deliberately reintroduce three or four times this amount of bagacillo as a filter medium, which is partly washed back in the recirculated cloudy filtrate, thus eventually finding its way into the boiling house.

Mr. Carter considered that bagacillo was put in the mud as a filter-aid and not in the juice.

Mr. Noel mentioned the case of a Mauritian factory which did not use any bagacillo in the mud and which still had a very good performance at the filters. This was not done on purpose but the screening of the mixed juice, although poor, had no adverse effect on clarification.