PERFORATED STEAM COILS—AN AID TO CIRCULATION IN "C" BOILINGS

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Hulett's Felixton Mill

Introduction

Difficulty was experienced at Felixton in boiling "C" massecuites, due to poor circulation and poor feed distribution.

Two 1,300 cu. ft. capacity pans each with 2,300 cu. ft. heating surfaces are used for "C" boilings, giving a heating ratio of 1.8.

The graining volume is 520 cu. ft. and the feed is through a centre pipe, the end of which is about 3 ft. from the bottom of the pan. An inverted funnel arrangement is attached to the discharge door of the pan, with a narrow opening round the periphery for the feed distribution. This inverted funnel is connected to the feed pipe by means of a short length of pipe which slides up and down inside the feed pipe and acts as a guide.

These pans were suitable for boiling "B" massecuites, but circulation was poor towards the end when boiling "C" massecuites. Considerable trouble was experienced with false grain forming in the pans and the crystallisers, especially with purities below 60°. It was also noticed that the feed rose up the down-take and floated on the surface of the massecuite when circulation slowed down towards the end of the boiling.

Two ¾ in. steam coils with 1/16 in. perforations six inches apart on the underside were installed below the calandria, two inches above the bottom of the pan.

The pan diameter is 13 ft. and the coil diameters are 11 ft. and 9 ft. respectively. Exhaust steam at 12 lb. per square inch pressure is blown through the coils when the pan is from a half to three-quarters full until the boiling is complete.

After the installation of the perforated coils in the "C" pans no difficulty was experienced with the boiling or in brixing the "C" massecuites. In fact the brix had to be limited to 95° as trouble was experienced in pumping and curing them at higher densities. False grain became a thing of the past. There was also a marked improvement in the exhaustion of the "C" massecuites and this resulted in a drop of several degrees in the purity of the "C" molasses.

The table below shows the brixes and purities at various levels in boiling "C" massecuites with steam-circulating coils.

At the time that the above tests were done only four 1,200 cu. ft. crystallisers were being used as the factory was being liquidated in preparation for the shut-down at the end of the season and the total cooling time was less than 24 hours in the crystallisers.

TABLE I
Brix and Purity at Various Levels.

Date	Cu. Ft.	Brix	Purity	Nutch at Striking	Nutch at Curing	Purity Molasses Ex. Centrifugals
5/3/68	450	86.3	74.2 (Seed)	—	—	—
5/3/68	920	93.6	60.7	—	—	—
5/3/68	1,120	94.7	59.9	44.6	34.6	37.9
5/3/68	450	88.4	74.0 (Seed)	—	—	—
5/3/68	520	89.7	70.6	—	—	—
5/3/68	720	91.1	63.0	—	—	—
5/3/68	920	92.9	60.2	—	—	—
5/3/68	1,120	95.0	59.2	43.9	35.7	37.8
6/3/68	450	88.7	75.2 (Seed)	—	—	—
6/3/68	920	95.2	61.1	—	—	—
6/3/68	1,120	97.0	59.0	43.8	34.9	36.6
6/3/68	450	89.4	74.0 (Seed)	—	—	—
6/3/68	520	90.8	63.0	—	—	—
6/3/68	720	93.6	59.4	—	—	—
6/3/68	920	92.0	57.0	—	—	—
6/3/68	1,120	94.2	57.1	43.0	34.3	37.1
7/3/68	450	88.8	75.2 (Seed)	—	—	—
7/3/68	520	89.4	72.4	—	—	—
7/3/68	720	91.2	66.6	—	—	—
7/3/68	920	92.6	64.1	—	—	—
7/3/68	1,120	95.2	62.8	45.1	35.3	38.0

Temperatures leaving the crystallisers 53° C. to 57° C.
Temperature entering centrifugals 58° C. to 60° C.

Temperatures taken at the discharge of the third test shown above:
° C. 69 70 69 70 70 70 70 74 76 77 71 69

Method of Boiling "C" Massecuites

Six hundred cubic feet of a blend of syrup and "A" molasses is grained at a purity of about 78°, using 1,500 ml of slurry. This is developed with 340 cu. ft. of syrup and completed to 1,500 cu. ft. with "A" molasses. 900 cu. ft. is cut to a seed receiver and used as seed for boiling two "C" massecuites. The remaining 600 cu. ft. of seed is developed with another 340 cu. ft. of syrup and completed with "A" molasses to produce 1,500 cu. ft. of "B" massecuites with a purity of 70° to 73°.

Four hundred and fifty cubic feet of seed 70° to 74° purity is cut to a "C" pan from the seed receiver and brixed to 89° to 90° then taken up with "B" molasses to 1,100 cu. ft. If the purity of the "B" molasses is below 50°, then an estimated amount of "A" molasses is added to produce a massecuite of 60° when completing with "B" molasses.

Discussion

Mr. Robinson: We had one very old fashioned pan at Darnall which refused to boil, particularly if "gummy" cane was coming into the factory. Mr. Phipson's steam coil was fitted and since then there has been no trouble.

Darnall has a stirrer in one pan which aids circulation to the same extent as a steam coil but whereas the stirrer cost about R7,000 the steam coil costs less than a tenth of that.

We operate at a pressure of 10 p.s.i. which we find adequate. Unlike Felixton, Darnall has automatic control of pan feed.

Mr. Jennings: I would like to mention that Felixton was the only Hulett mill to improve its exhaustion of final molasses compared with the previous season and had the best exhaustion of final molasses of the Hulett group.

Mr. Girdler: We fitted a steam coil to a recalcitrant pan at Empangeni about fifteen years ago and it was most successful.

Incidentally, I think if Mr. Jennings checks his records he will find that Amatikulu also increased its exhaustion of final molasses last season.

Mr. Warne: The S.M.R.I. has carried out intensive research into circulation inside vacuum pans.

We have carried out measurements with the steam circulator mentioned by Mr. Robinson at Darnall and although our results are not ready for publication it appears that there is a danger of overheating underneath the calandria just above the steam coils. We may therefore be improving our circulation at the expense of loss of crystal.

Mr. Phipson: First, in answer to Mr. Robinson, we operated our coils at 100 p.s.i. and controlled them with globe valves, starting with them half open. We were then definitely overheating our massecuites. We changed to exhaust steam at 10 to 12 p.s.i. and with two $\frac{3}{4}''$ coils the valves were left fully open. Boiling deteriorated towards the end of the season so during the off season we removed the coils and reduced the size of perforations to 1/16″ as they had become enlarged due to erosion.

As regards loss of sucrose, the amount of steam in the $\frac{3}{4}''$ coils compared to the amount going into the calandria is small.

Mr. Girdler: Referring to Mr. Warne's comment, I have always placed these coils above the calandria and never below it, in order to create a void above the calandria and allow the sugar to come up.

Mr. Robinson: The mechanical stirrer in one of our pans operates slowly or fast. The maximum temperature is recorded when it is running fast.

Mr. Warne: Temperatures have been recorded in this stirrer pan at eight positions and there are six conductivity positions. When the stirrer is changed from a high speed to a low speed the temperature drops. If it is changed from a low speed to the "off" position the temperature drops again, by as much as 5°C.