

THE NEW SMRI NUTSCH BOMB

By S. MUNSAMY

Sugar Milling Research Institute

Abstract

The SMRI has developed a new nutsch bomb which has several advantages over existing models. It is lighter, easier to load/clean and separates molasses at a faster rate. Purities of molasses from the SMRI bomb were the same as those from conventional nutsch separators.

Introduction

The conventional nutsch bomb using a horizontal screen arrangement had proved to be very slow in extracting molasses from a massecuite sample. A more recent design described by Lionnet and Falconer¹, and usually referred to as the Hulett's nutsch bomb, contains a larger screen area but is still slow when used on viscous massecuite. In addition it is heavy and difficult to load with massecuite.

Nutsch purities provide valuable information for process control and quick results are desirable. Long extraction times are to be avoided because massecuite conditions may change in the bomb and mother liquor purity may be affected.

A study of the disadvantages of the existing equipment led to the development of the SMRI nutsch bomb which is described in this paper.

Development of the new bomb

Preliminary studies showed that the volume of massecuite decreased considerably in the bomb when pressure was applied, due to escaping air bubbles and to molasses extraction. The massecuite level therefore moved down in the bomb. This slight movement probably produced a scraping effect which could reduce the build up of crystals on a vertical screen in the bomb.

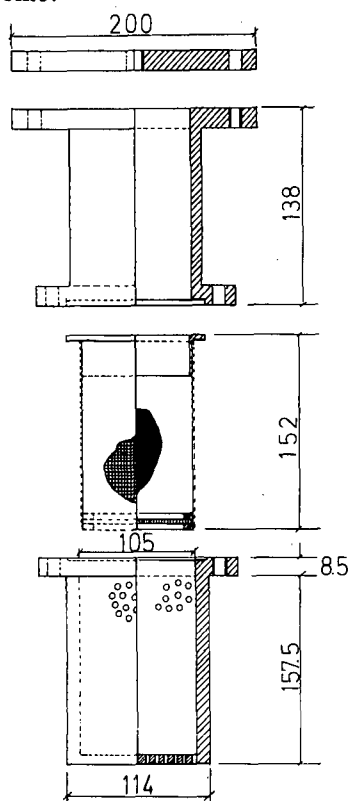


FIGURE 1 Nutsch bomb — Model 1

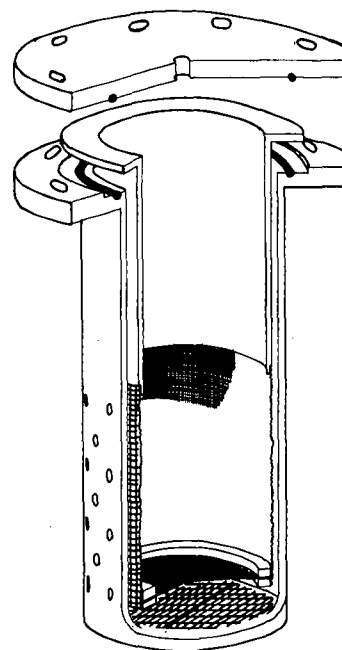


FIGURE 2 Nutsch bomb — Model 2

It was therefore decided to use a cylindrical screen which would promote the scraping effect and at the same time offer a large screen area. This could be achieved with a bucket type screen which would also meet the requisites of fast assembly and easy cleaning.

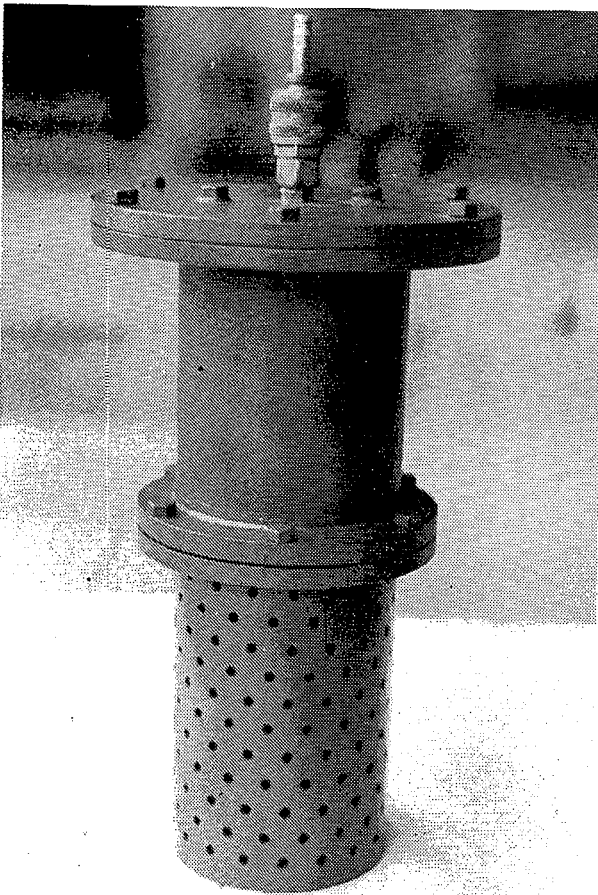
Temperature control of massecuite in the bomb was studied and the conclusion was reached that it was impossible to reheat uniformly massecuite in the nutsch bomb without remelting of crystals. A better approach would be to retain the established practice of jacketing the bomb and to design the bomb for fast loading in order to reduce heat loss when massecuite is transferred to the bomb. Jacketing proved impractical with the design adopted, but the bomb was fitted with a copper coil through which water could be circulated. The coil was immersed in the massecuite and its inlet and outlet protruded through the top cover of the bomb. It was found that in practice, the coil was not necessary for process control purposes because of the very reduced screening times.

Description of the SMRI bomb

Two models were produced. The first (Figure 1) is flanged in the middle. The second model (Figure 2) has a one piece outer jacket. The second model is easy to assemble and dismantle but its screen cage is difficult to fabricate and seems to tear easily. The first model is recommended and is described below.

An outer jacket made from a 114 mm outside diameter pipe consists of two parts. The lower part is 166 mm long and houses the screen cage. It is drilled with 276 holes of 5 mm diameter and is flanged at the top. The bottom is closed by a perforated plate. The flange is grooved to accommodate the screen cage lip and is made airtight by means of a rubber "O" ring.

The upper part is 138 mm long and has flanges on both ends. The lower flange fastens onto the lower part of the



Nutsch bomb — Model I

outer jacket. The cover is fastened to the top flange and is made airtight by means of another rubber "O" ring. The screen cage is bucket shaped and consists of the screen and the backing screen. The screen is of 100 mesh stainless steel and the backing screen is of 4 mm woven mesh.

The top cover is cut from 85 mm thick steel plate. It is fixed to the outer jacket top flange by butterfly nuts and bolts. An inlet for compressed air is drilled in the centre of the cover.

Evaluation of the SMRI nutsch bomb

A series of comparative tests was carried out between the SMRI and Hulett's bombs at the Noodsberg, Felixton and Illovo mills. A few comparisons between the SMRI and the conventional bomb were also made at Tongaat. Most of the comparisons were carried out with the SMRI bomb fitted with a 100 mesh screen and the Hulett's bomb with a 0,06 mm centrifugal screen. The circulation water temperature of the Hulett's bomb was always maintained at the temperature of the massecuite sample. The results of these experiments indicate that :

(1) At a temperature of 53° to 55°C, which is normal for feed to C-centrifugals, the 50 grams of molasses required for an apparent purity determination was obtained in 2 minutes (Table 1). For more viscous massecuites at lower temperatures the time required increased up to 8 minutes which is still much better than with other designs. In extreme cases where no flow at all could be obtained from the existing bombs, the 50 grams of sample was obtained from the SMRI bomb in 15 to 20 minutes.

TABLE 1

Extraction times for the collection of 50 grams of molasses samples from C massecuite

| Run No. | Mill | Massecuite Temp °C | Extraction Time (min) |
|---------|------|--------------------|-----------------------|
| 1 | NB | 37 | 8 |
| 2 | NB | 61 | 2 |
| 3 | IL | 51 | 2 |
| 4 | IL | 36 | 8 |
| 5 | IL | 53 | 6 |

(2) Changes in temperature of the massecuite in the bomb were noted during separations. It was found that the maximum temperature drop was only 1°C during runs 1 to 5 in Table 1. Further tests carried to determine the rate of cooling of massecuite in the bomb were performed by inserting a thermocouple in the massecuite through the bomb cover. The results listed in Table 2 indicate a drop in temperature of only 3°C over 13 minutes. It was therefore decided not to provide the bomb with thermostatic water jacket.

TABLE 2

The cooling rate of massecuite in the SMRI nutsch bomb

| Time in Minutes | Massecuite Temp °C | Time in Minutes | Massecuite Temp °C | Time in Minutes | Massecuite Temp °C |
|-----------------|--------------------|-----------------|--------------------|-----------------|--------------------|
| 0 | 50,5 | 5 | 49,0 | 10 | 48,0 |
| 1 | 50,0 | 6 | 49,0 | 11 | 48,0 |
| 2 | 50,0 | 7 | 48,5 | 12 | 47,5 |
| 3 | 49,5 | 8 | 48,5 | 13 | 47,5 |
| 4 | 49,5 | 9 | 48,0 | | |

(3) In order to find out if there was a difference in the purity of molasses extracted early or late in a nutsch screening operation, molasses was sampled at different time intervals after loading and was analysed for purity. The operation was carried out with the SMRI bomb and the results are listed in Table 3. They show that time has no apparent effect on the purity and that molasses extracted early in the cycle is representative of all the molasses which can be separated from the massecuite.

TABLE 3

The effect of extraction time on molasses purity

| Time in Minutes | Molasses Purity |
|-----------------|-----------------|
| 2 | 26,9 |
| 4 | 26,6 |
| 6 | 26,9 |
| 10 | 26,4 |
| 20 | 26,4 |

(4) Tests were carried out to compare purity of molasses from the SMRI bomb with that of molasses from the Hulett's bomb. Massecuites of different brix and temperature were used for the test. The results of the tests are listed in Table 4. They confirm that with normal massecuites, the type of bomb used did not influence molasses purity even when the two bombs were not fitted with the same type of screen. For these tests, the Hulett's bomb had a 0,06 mm centrifugal screen and the SMRI bomb was fitted with a 100 mesh screen.

TABLE 4
Nutsch purities from SMRI and Huletts' bombs

| Run No. | Massecuite | | | Nutsch purity | |
|---------|------------|------|---------|---------------|---------|
| | Bx | Pty | Temp | SMRI | Huletts |
| 1 | 93,9 | 47,3 | 40° C | 26,8 | 26,9 |
| 2 | 93,7 | 51,6 | 42° C | 28,7 | 28,8 |
| 3 | 95,8 | 48,6 | 60,5° C | 35,0 | 34,2 |
| 4 | 94,7 | 48,1 | 60° C | 27,3 | 27,5 |

Further tests carried out under factory conditions by the Felixton mill staff, over a two week period, confirmed these findings. The average results of 127 sets of comparisons made at Felixton are listed in Table 5.

TABLE 5
The Felixton comparison test results

| Type of Bomb | Nutsch Purities | | |
|--------------|-----------------|-----------------|-------------|
| | Ex Pans | Ex Crystallizer | Ex Reheater |
| Huletts' | 41,1 | 33,2 | 33,0 |
| SMRI | 41,1 | 33,0 | 33,0 |

Conclusions

The new nutsch bomb developed by the SMRI has several advantages over the conventional bombs used for industrial control of process work. It is lighter, easier to operate and considerably faster on viscous massecuities. Purity of molasses separated in the new bomb is not different from that obtained with existing bombs.

For best results the SMRI bomb should be installed on the pan floor. Double handling of the massecuite and cooling in sample buckets are thus eliminated.

Acknowledgements

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REFERENCES

1. Lionnet, G. R. E. and Falconer, D. (1975). The evaluation of a new nutsch bomb design. *SASTA Proc* 49 : 86-89.