

EXPERIENCES WITH A DENSITY METER

By A. F. DUCASSE

Summary

The use of this instrument, utilising galvanic action to indicate the density of massecuite as a guide to crystallization in sugar-boiling vacuum pans and its construction from cheap and readily available materials are enlarged upon.

Difficulties experienced in the instrument's successful operation are enumerated and the means of overcoming these are set forth as a guide to present and future operators.

Introduction

It will be recalled that in 1954, a paper entitled "An Aid to Pan Boiling" was read and received the interest of many members of this Association. This was followed in 1955 by an explanation of the method used.

Many factories in Natal, Zululand, Rhodesia and Portuguese East Africa have used the Density Meter with varied forms of success. Of those who have tried to put the method of "Pan Aid" into practice, many are divided in their opinion as to its efficacy.

The blame has been put on the practical side of the instrument, i.e. faults which may arise from time to time due to various causes. The theoretical side has been accepted. The causes impairing the reliability of the instrument in its functioning could in most cases be eliminated by proper care as the writer will endeavour to explain.

Use of the Instrument

At Renishaw, where "B" massecuites are found to be the most difficult to boil, the pan boilers more or less bank on the meter for these massecuites.

When boiling a "C" massecuite with a very slow pan the Meter has proved to be extremely useful and it has been found to be often more accurate than the finger and thumb method for determining density.

When it comes to graining, the shock seeding system is used. As it has been ascertained to complete satisfaction that there is a definite relation between "shock" and "grain" as shewn in the accompanying chart (Fig. 1), the Meter again proves to be of immense value.

The lower the density of the concentrated liquor when "shocked" the higher the density of the liquor before the formation of crystals and vice versa.

The three instruments installed at Renishaw are serviced regularly and are kept in continuous good condition and working order.

Difficulties in Operation

The failure of instruments installed in other factories may be attributed to:

- (1) Faulty Switch. The switches, as used on the Density Meter, are of delicate mechanism and certainly cannot stand up to rough handling. Furthermore, in time, contacts corrode and during the process of corrosion may be erratic in efficiency. These switches can, however, be replaced at negligible cost.

- (2) The electrode itself tends to disintegrate in acid solution. This after all is galvanic action and it is on this theory the Density Meter is based.

Experience has shown that "zinc alloy", as used in torch battery shells, makes a more lasting electrode.

Construction from Cheap Material

It is suggested that anyone having trouble with the usual electrode should try a "home made" one as shewn in the diagram (Fig. 2).

The washers utilised are punched out of old torch battery shells. The electrode should comprise of two banks of say 25 x 25 of these discs or washers.

Care of Instrument

It will then be found that in processing "C" massecuites the electrode should need no attention other than a periodical check, or if the instrument shows any sign of erraticism.

When used on "B" massecuite, the usual steaming out after a strike may not entirely clean the electrode and consequently, after a few weeks, accumulation of sugar on the discs may tend to short-circuit the electrode.

If used constantly on syrup, scales are liable to form and give a false reading when graining. Density reading on "A" massecuite when striking is not accurate.

In the case of "B" massecuites, purity will have an effect on density when striking.

With "C" massecuites density when striking is very accurate.

Calibration

Another point must be stressed. The Meter is not a "Robot Panboiler". The pan boiler must calibrate it in conjunction with his own method of boiling and he must get it into his mind that the instrument will not replace him.

Should any Process Manager want to experiment further, any reliable make of recorder of 0 to 1 M.A. D.C. with the usual resistance and switch to give ranges 0 to 10 m.a. and 0.100 m.a. will serve the purpose and prove very interesting, especially with "B" and "C" massecuites.

Conclusion

To the many who are using the Density Meter in other factories and have had poor results it is hoped that this short paper will prove helpful and if the enthusiasm shown by so many in 1954-55 can be revived, the author will feel well compensated.

Acknowledgement

I also would like to convey thanks to Mr. Louis Crookes for the graph and drawing.

Reference

- ¹DUCASSE, A. F. Proceedings S.A. Sugar Tech. Assoc., Vol. 28, 1954, p. 115.

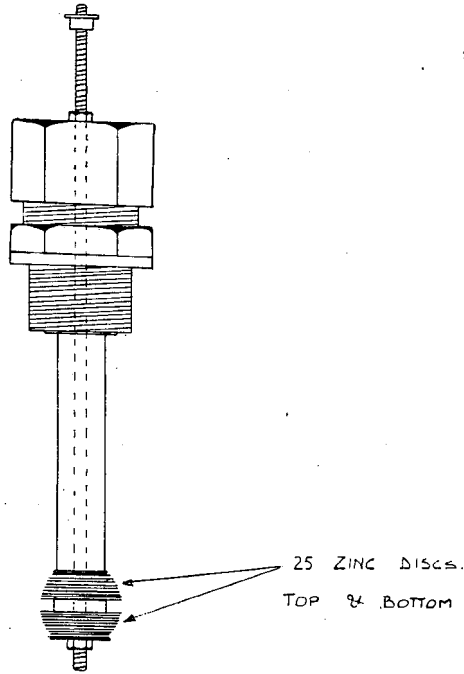


CHART SHOWING RELATION OF SHOCK TO GRAIN PERIODS



Dr. Douwes Dekker (in the Chair) said there were various methods of pan boiling control. Some depended on the boiling point of the massecuite at the particular vacuum, some on the conductivity of the mother liquor as an indication of its supersaturation.

Mr. Ducasse had developed an instrument which did not require an external source of electric current. In 1954 he first gave a paper describing his instrument and another discussion took place in 1955. He now gave directives, after another six to seven years' experience particularly to those using the instrument, and these directives would prove useful to those operatives.

Mr. F. Johnston asked what was the real advantage of this instrument over the usual type. Was it a matter of cheapness or was the instrument more accurate? He mentioned that at Tongaat there was an instrument, which by amplifying the electric current, was enabled to control the valves feeding the vacuum pan.

Mr. A. F. Ducasse said that the advantages of his instrument were its simplicity and reliability. The other electrical pan boiling instruments depended upon thermionic valves which were not always reliable.

Mr. E. H. Phipson thought that one of the main advantages was that it was independent of varying current.

Mr. W. F. Davies asked if there was a possibility of amplifying the current produced, so that it could operate a feed valve on the pan.

Mr. A. F. Ducasse replied that the current produced was very small, but it could operate the meter and thus the current could be stepped up.

Mr. Rault stated that the instrument was used at Natal Estates with very satisfactory results. The directives now given would still more enhance its value. He thought that a lot of troubles encountered in pan-boiling were due to our not having operatives who were sufficiently trained and he believed that more research and better training of operatives were indicated.

Mr. E. T. J. Dedekind said that this instrument could be used in raw sugar solutions and at Sezela Refinery it was employed as a guide in the raw sugar melter. The zinc discs did not last long in the raw sugar liquor and he asked the author if he could suggest an alternative to them. The discs used at Sezela were purchased as such and not cut from torch cells.

Mr. A. F. Ducasse replied that the discs he used were readily available and so cheap that he did not recommend any alternative. He had been told that the zinc used in torch cells became more porous, but he found the discs cut from the cells was most reliable.

Mr. W. D. Robertson said he believed the zinc used in torch cells was of very high purity and possibly the zinc used by Mr. Dedekind was not of such good quality.

Mr. C. L. Wagner said he had experienced difficulty through the electrodes dissolving.

Dr. K. Douwes Dekker said it was obvious that the quality of the zinc was most important. We did not quite know how the instrument worked except that a current was generated and this showed on the meter, but how the concentration of the liquor affected the current was not understood. From a practical point of view however there was no doubt that the instrument was a great help and he thanked the author for the further advice he had presented to users of the instrument.