

PAN CONTROL METHOD IN PRACTICE

(COMPLEMENTARY TO "AN AID TO PAN BOILING")

By A. F. DUCASSE

It may be recalled that a paper "An Aid to Pan Boiling" was read at the Twenty-eighth Annual Congress of the South African Sugar Technologists' Association in 1954.

Since then, great interest in the new method of pan control has encouraged the author to elaborate on the system from a practical angle.

In practice, it must be admitted that as an aid to pan boilers, any instrument used must be a simple device, of robust construction and more or less foolproof.

As the method is based on galvanic action and can produce, with suitable electrodes, a measurable current which can be of .5 m.a. or less to an unlimited maximum (according to the electrodes used) it can be understood that a milliammeter with a range of 0—100 m.a. will be difficult to read with the desired accuracy, but when the instrument is of a range of 0—1 m.a., with resistances incorporated and switching arrangement giving ranges—

0—2 m.a. 0—10 m.a. 0—100 m.a.

we can attain our purpose and find the sensitivity and accuracy which is required for pan work.

Although the voltage obtained is low, being below .2 volts DC to .8 volts DC, the construction of a recording device should offer no difficulty.

The electrodes, although showing signs of scaling-up when on test in the laboratory, show no appreciable deterioration when used in practical pan boiling. This was proved when one electrode was used at Renishaw throughout the 1954 season and the meter readings were graphically correlated against the densities of "C" or third massecuites boiled during the season.

While on the subject of electrodes, the following may be mentioned:

- (1) measurement of capacity in Mfd between electrodes is not essential to practical pan boiling;
- (2) surface area does not play the part one would expect. At Renishaw, a machined electrode of solid zinc with apparently more surface area than a zinc disc electrode proved unreliable;
- (3) to step up current, one electrode with two or more banks of zinc discs which must be so separated as to produce the same effect as electrodes in parallel;

- (4) sufficient clearance must be allowed between the pan wall and the electrode or electrodes, so that after discharging the heavy massecuite and subsequent steaming out of the pan, no accumulation of massecuite is left to give a false reading.

Experiments made in other factories gave practically the same readings as those obtained with the meter used at Renishaw.

Unfortunately different types of electrodes were used, but results tend to prove that whether the slurry method or shock seeding was in operation, even at varying purities and temperatures, the saturation point for the introduction of slurry or shock seed showed little variation.

It must be borne in mind that individual pan boilers have a different "touch" to determine the density prior to introduction of slurry or shock seed.

It can also be assumed that there is a definite relation between the density of the liquor at the time of introduction of seed and appearance of the required number of crystals.

It is thus possible that were the electrodes standardised and pans calibrated, more uniform graining could be obtained when using the new method of pan control.

There have been queries as to whether the method could be used successfully with steel pans.

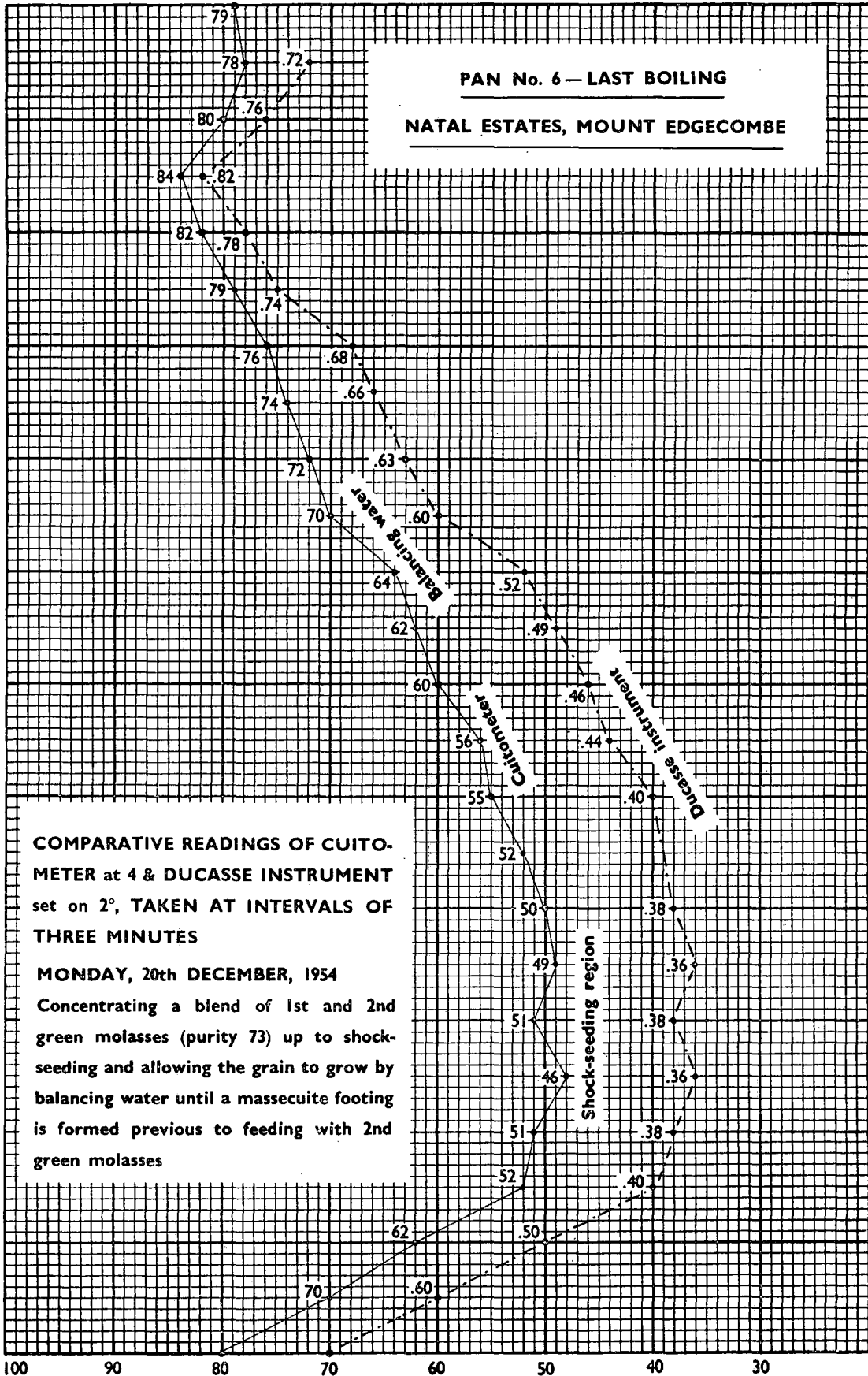
Should there not be sufficient measurable current when using the steel wall of the pan as one electrode, then two electrodes should be introduced, one of cast iron or of similar metal and the other of zinc discs, as used in the cast iron pan.

In the laboratory, the instrument has been found to be sensitive to change in pH, yet in practical work the introduction of hydrosulphite of soda ("blankit") into the pan while graining made no difference to the reading.

However, when boiling weekend syrups, it was found that there was an appreciable change in the readings of the meter and consequently it is suggested that a different graph for such conditions be prepared.

Any instability or flickering of the needle would show that the pan is not boiling normally, i.e. drawing air, defect in vacuum system or abnormal changes of temperature.

PAN No. 6 — LAST BOILING
NATAL ESTATES, MOUNT EDGECOMBE

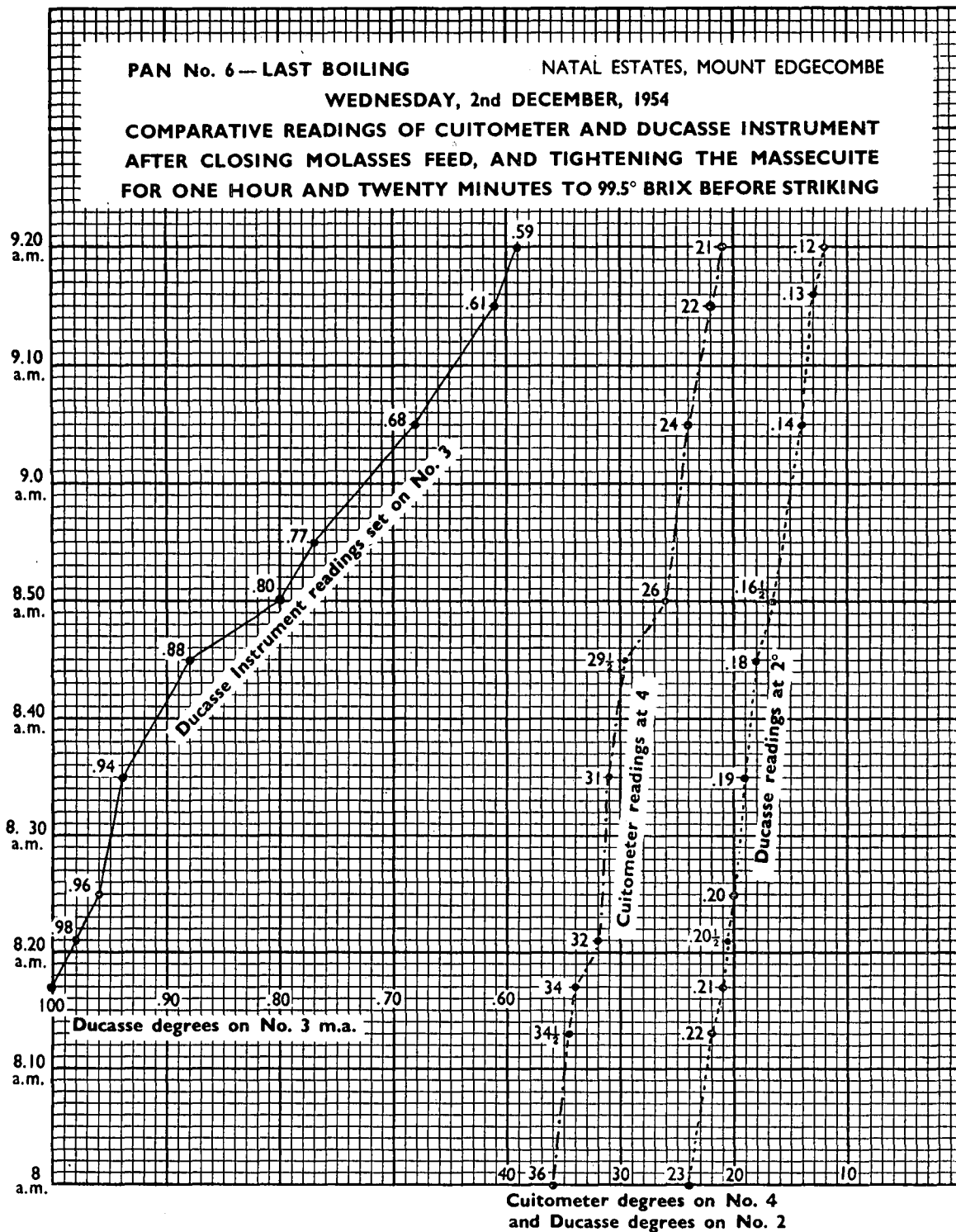


COMPARATIVE READINGS OF CUITO-METER at 4 & DUCASSE INSTRUMENT set on 2°, TAKEN AT INTERVALS OF THREE MINUTES

MONDAY, 20th DECEMBER, 1954

Concentrating a blend of 1st and 2nd green molasses (purity 73) up to shock-seeding and allowing the grain to grow by balancing water until a massequite footing is formed previous to feeding with 2nd green molasses

Shock-seeding region



An interesting comparison between the pan aid instrument and one of the conventional recording types was made by Mr. J. Rault and a graph shewing the readings of the two instruments during the boiling of a "C" massecuite at Natal Estates, Ltd. factory is appended.

In conclusion I would like to thank the President, members of the Council and of the Association for the kind interest they have shewn and the valuable assistance extended by various technologists.

I also would like to convey special thanks to Messrs. Crookes Bros., Renishaw.

Mr. Rault, the Chairman, said that it was rather rare to obtain a valuable contribution of this nature, from a practical pan boiler. He said that this paper was a continuation of the one written by Mr. Ducasse last year. Mr. Rault remarked that a deputation invited by the Council went to Renishaw to see the pan control instrument under actual working conditions. A pan boiler from another factory, who had no experience of the instrument, was quite successful in boiling a pan with the instrument alone. After this there was a discussion, when various questions were asked and satisfactorily answered. He was so satisfied with the instrument that he took it to Mount Edgecombe, where it was placed side by side with the cuitometer, as shown on the graph for the 3rd massecuite. He was quite satisfied with its working.

Mr. Elysee said he had tried the machine out in the laboratory with varying densities and varying temperatures. (He demonstrated his findings on the blackboard.) He said that he found that an increase in temperature gave a regular increase in reading on the instrument. This he found was due to the evaporation of the syrup sample under tests. He then tried out another test where the temperature was kept constant and water was added drop by drop to lower the density. Again the machine faithfully recorded differences in density. He found in the laboratory, by introducing SO_2 , that this had a great effect on the readings. These tests were made parallel with the cuitometer. The cuitometer, however, did not show any differences with decrease of pH. This would account for the difficulty experienced by Mr. Ducasse when boiling week-end syrups. He found that air occluded in the syrup sample through speeding up the stirrer used also to affect the readings. He duplicated these tests on first and third molasses with very different results from those obtained on syrups. When the machine was fitted to the vacuum pans, he found that scaling occurred. There was a difference between the first

day's readings and subsequent ones. He had to alter Mr. Ducasse's electrode to get it into the pan, which meant that the electrode had to be ground down, so that it became almost a solid core. He found on dismantling the electrode, a black deposit on the discs, which he thought was due to sulphur.

Mr. Tonner asked what was the difference between this machine and the ordinary cuitometer.

Mr. Ducasse replied that in the case of most sugar factories there were tremendous variations in current, which affected the cuitometer, but of course this did not affect his instrument. Variations in current led readings to be unreliable. In his case he said his machine was not dependent on outside fluctuations in current.

Mr. Elysee said that he found enormous variations in the cuitometer at Amatikulu.

Mr. Galbraith supported this, saying that he had similar difficulties with the cuitometer at Sezela, so when he heard of Mr. Ducasse's instrument he installed them especially for C massecuite and he found that he got much better results from Mr. Ducasse's instrument. The pan boilers took to the instrument immediately, and were quite upset when the instruments had to be taken away and returned to Renishaw.

Mr. Phipson enquired what massecuites the machine had been tried out upon. He also considered an important advantage of the machine was the low cost.

Mr. Ducasse said that in its present form, without a recorder, the price was £35, but even with a recorder added, it would be much under £100.

Mr. Rault enquired if the machine would work satisfactorily on very pure massecuites.

Mr. Ducasse replied that he thought that it would be successful, but it would probably be necessary to increase the size of electrode.

Mr. Rault said that one of his pan boilers had said that he could notice differences in concentration rather more quickly than the machine recorded them.

Mr. Hardy bore out this contention.

Mr. Elysee pointed out that the cuitometer also showed a time lag, and this instrument would also do so for the same reason, which was in his opinion solely to the poor circulation in the pan.

Mr. Bax said that cuitometers were used in Mauritius for all massecuites and that he found that they were more accurate for C massecuites, but in general the strikes using the cuitometers were very, very satisfactory.

Mr. Elysee said that the machines were tried out at Amatikulu, specially because of the introduction of slurry graining, as in this case it was necessary to know exactly at what point to introduce the slurry. He found the refractometer gave the most reliable results, but this did not apply to B and C massecuites, for which products the cuitometer or Mr. Ducasse's instrument gave reliable results.

Mr. Tonner said that when using pre-cured syrups such as the liquor from the char in the refinery, the ash content was very low, and he wondered if any electrical instrument could give reliable results, because of the small amount of current passed. He said he was particularly interested in the use of such instruments for his lower grade massecuites and he wondered if the charts prepared for syrups of say 80° purity would be reliable, when later on the syrup purity changed to 85.

Mr. Ducasse replied suitably. In reply to Mr. Hardy, Mr. Ducasse said the machine had proved quite reliable on A massecuites, which were compiled from syrup alone.

Mr. Sergeant asked if anybody had used such an instrument on the crystalliser to keep a check on dilution.

Mr. Ducasse said the instrument could probably be used, but he would not like to say how accurate it would be.

Mr. Elysee said that although he had not much experience with this, he thought Mr. Ducasse's instrument was so sensitive that it could be used with success on the crystalliser. He said to get the utmost success from the instrument the electrodes should be changed with every graining.

Mr. Rault pointed out that as Mr. Elysee had shown, the temperature made a big difference, apart from density, so if one wanted to control dilution alone there would be another factor interfering, namely, the drop in temperature during cooling in motion.

Mr. Galbraith said an important point in factory management was the tightening up of the 3rd massecuite and he had found that for this purpose the machine was extremely reliable.

Mr. Hardy asked if the instrument could be used as a density indicator for the syrups leaving the evaporator?

Mr. Ducasse considered that for this process there might be too much scaling up of electrodes.

Mr. Elysee thought the instrument could be used with success for measuring densities of syrup, provided this density was kept within certain limits.