and physical properties of virgin and spent palm oils, especially with respect to the effect of these properties on the action of these oils in the tin bath.

Based on the results of this investigation, and on information and cooperation of various producers and consumers of tin plate, efforts were made to produce from cottonseed oil a product which would be equal to or superior to palm oil with respect to its performance in the tin bath.

It was found that, of the various types of selectivity hydrogenated cottonseed oils which were investigated, one having an iodine number of approximately 50 was best adopted as a palm oil substitute for use in the tin bath. The effect of heating hydrogenated cottonseed oils on the viscosity, rates of free fatty acid formation, rate of volatilization, effect of flux, and other factors were determined.

Based on these results and further evaluation of the hydrogenated cottonseed oils by various producers of tin plate, specifications were formulated covering a product which it is believed will provide optimum performance and maximum life in the tin bath.

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A Nomograph for Emergent-Stem Correction of Mercury-in-Glass Thermometers

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Because it is not always possible to take temperature readings under the condition of total immersion of the mercury column, it is the usual practice to dip the bulb of the thermometer and a part of the stem in the material under investigation and then to make the necessary correction for the temperature observed. The formula (1) for calculating this correction (S) is $an(T\text{-}t)$, where a is a factor representing the relative expansion of mercury in glass, n is the number of degrees of mercury emergent from the bath, T is the observed temperature, and t is the average temperature of the emergent mercury column. The latter is measured by means of a second thermometer the bulb of which is placed about three-fourths the distance down the exposed mercury column. Although the value of a depends upon the kind of thermometer glass and the magnitude of the temperature being measured, its average value is taken as 0.00016 for Centigrade temperature and 0.00009 for Fahrenheit.

An occasional need for making temperature corrections probably does not justify the use of short cuts, but in those laboratories where many temperature readings are a part of routine control or of research, any aid which will reduce the labor of making calculations obviously is desirable. This aid may take one or more forms.

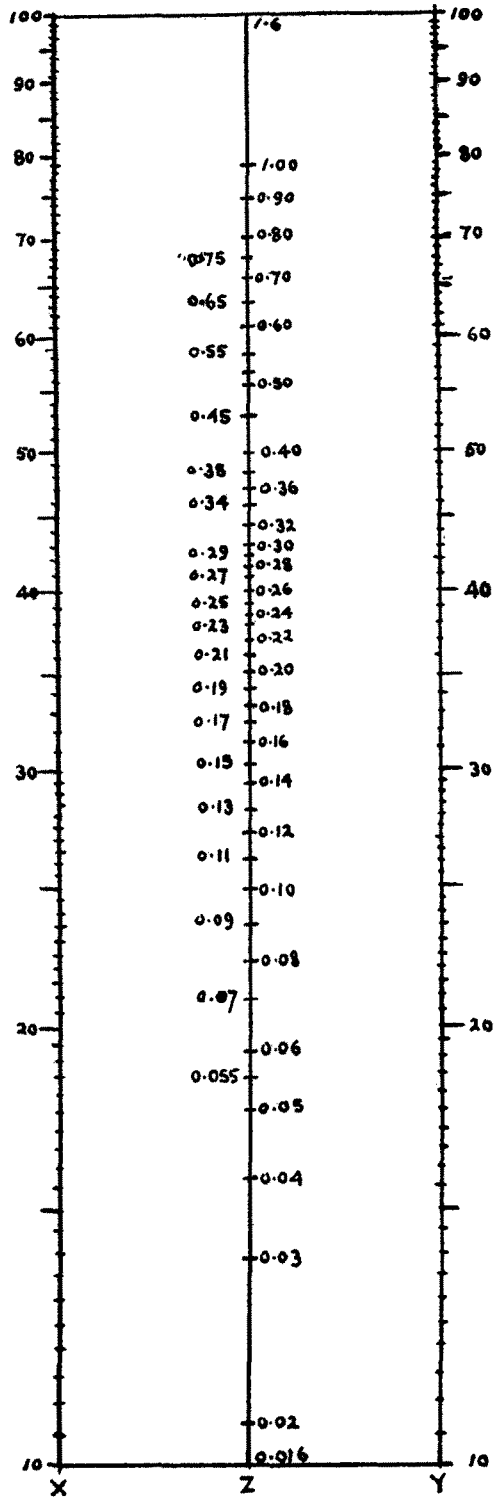
Assuming an average value of a, it is a simple matter although a somewhat laborious procedure to construct a stem-correction table covering the possible range of n and $(T\text{-}t)$. Better still, it is easier to construct a nomograph which is much more convenient than a table and gives without undue extrapolation the required values to a degree of accuracy demanded even by an exacting worker.

Stem-correction tables may be found in standard reference works and elsewhere,* but apparently no mention has heretofore been made of a nomograph for this purpose. Such a nomograph has therefore been constructed and found to be of great help in this laboratory. It is reproduced here in the hope that it will facilitate the work of others.

In the construction of this nomograph, the equation (1) in question, was rewritten as $\log S = \log a + \log n + \log (T\text{-}t)$. Since a is constant, it contains only two variables, n and $(T\text{-}t.)$ They were laid on two parallel logarithmic scales as shown at the x and y axes. The range for n and $(T\text{-}t)$ was taken as 10 to 100° C. Since the scales for x and y are made identical, a third axis (z), midway between them and parallel to both, gives the correction. The scale on z was constructed by taking $a = 0.00016$, a value which holds good for a range of temperature of 0 to 300° C.

It is not necessary, however, to construct a longer scale to cover this range; any value between 0 to 10° C. and 100° to 300° C. can be made to fall on the scale by a shift of the log cycle and a shift in the decimal point on the correction factor. Thus the x

* The widely published tables of Rimbach (*Z. Instrumentenk.*, 10: 1890, 153) have but a limited application because his data were obtained by the use of a special thermometer in a distillation apparatus.[1]



Nomograph for Emergent-Stem Correction, Centigrade Scale.
x axis = emergent degrees, y axis = temperature-difference, z axis = correction.

and/or y axis may represent 0 to 10° C., 10 to 100° C., or 100 to 1000° C. at a time. This is shown below in one of the two cases illustrating the practical use of the nomograph.

Case 1. T is not larger than 100

$T = 100°$ C., $t = 45°$ C., $n = 80°$ C.

A straight edge is placed at 80 on the x axis and at (100–45) = 55 on the y axis.

The correction is 0.7° C.

Case 2. T is larger than 100

$T = 300°$ C., $t = 100°$ C., $n = 110°$ C.

A straight edge is put at $\frac{110}{10}$ or 11 and at $\frac{300-100}{10}$ or 20.

The correction is $0.035 \times 100 = 3.5°$ C.

The serviceability of the proposed nomograph is illustrated in the accompanying table (2) in which have been used data for the Pensky-Martin flash-point apparatus. In the last column are given values as obtained from the nomograph. They show complete agreement with the other set of values.

TABLE 1

Comparison of Stem-Correction Values

Thermometer reading °C.	Mean temperature of emergent column °C.	Mercury column emergent °C.	Stem correction	
			Wilhelm[2] °C.	Nomograph °C.
50	35	30	0.1	0.072
100	45	80	0.7	0.7
150	55	130	2.0	1.98
200	75	10	0.2	0.21
250	85	60	1.6	1.6
300	100	110	3.5	3.5

A similar nomograph could be constructed for Fahrenheit thermometers taking $a = .00009$, or for other thermometers where a has a different value (3). It may be also pointed out that the nomograph will be of service in those cases where a Beckmann thermometer is used; because even here, the ultimate expression for correction reduces to a product of two factors and a (3).

If there could be any criticism against the use of such a nomograph, it may be due to the fact that in the lower ranges it gives corrections to a degree of accuracy beyond the sensitivity of the thermometer used.

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