consists of a Number 1 operator, a Number 2 operator, and a pump man. The Number 1 operator is in charge of all plant operations and is assisted by the Number 2 operator, whose major function is to keep a strict watch over the instrument control operation and to keep the operating records. The pumper's responsibility is to see that the feed tanks are filled with crude stock and to make stock transfers as required. He is also responsible for the hourly weight checks which are used to estimate operating efficiency. In addition to these men, there are one plant supervisor and one man assigned to general housekeeping and utility work.

Conclusion

The decolorization of tallow by liquid-liquid extraction in propane is a significant advance in the treatment of tallows. It greatly surpasses the effectiveness of bleaching earths and chemical bleaches such as have been in use for many years.

Comparative Determination of the Consistency of Fats

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IF one has to compare the consistency of a standard fat with the consistency of fat mixtures prepared in the laboratory, a penetrometer of the type described by Freyer (2) and by Feuge and Bailey (1) is of great help. The depth of penetration of a needle entering with a known force into the fat is a measure of the consistency, and identity of consistency may be assumed if the penetration has the same value for the standard and for the examined sample. Naturally, where the goal is to meet the consistency of a given standard, a certain (and sometimes a very great) number of mixtures has to be prepared before the desired identity will be reached. In each mixture it is necessary to know how much the experimental preparation differs from the standard if one is to give proper direction to the further investigation. The answer given by the penetrometer is, in this special case, unsatisfactory for penetration measurements determine only how much two samples are different at a given temperature. As a matter of fact, it is not certain that the same difference will be observed or maintained at another temperature as penetration is by no means a linear function of temperature. To make sure of an increasing resemblance of sample to standard, it would be more advantageous to know for a given sample how many degrees above or beneath a given temperature it assumes the consistency of the standard. This knowledge requires at least three determinations with the penetrometer at different temperatures and the construction of a curve, which is too long a procedure for a routine test.

Gradual approach to the standard is more easily observed with the apparatus described here, in which a metallic weight falls through a sample of the fat at the moment when its consistency, under the influence of heating, has attained a definite value. The observed consistency is defined by the range of temperature in which the falling weight covers a predetermined distance. Thus one is informed at which temperature a given sample has the same consistency as the standard. The difference between the new apparatus and the penetrometer is that the penetrometer gives the consistency at a well-defined temperature whereas the new apparatus indicates the temperature at which a sample has a well-defined consistency. One consistency only, that which corresponds to the weight of the metallic cylinder, serves to establish the degree of resemblance between sample and standard. Theoretically, any consistency of an infinite number may be chosen; it is necessary only to increase or to diminish the weight of the metallic cylinder. Practically, the choice is made in such a manner that the cylinder begins its course at a temperature easy to observe. It has to be sufficiently light that it cannot fall until the temperature is about 30°C., and it should be sufficiently heavy

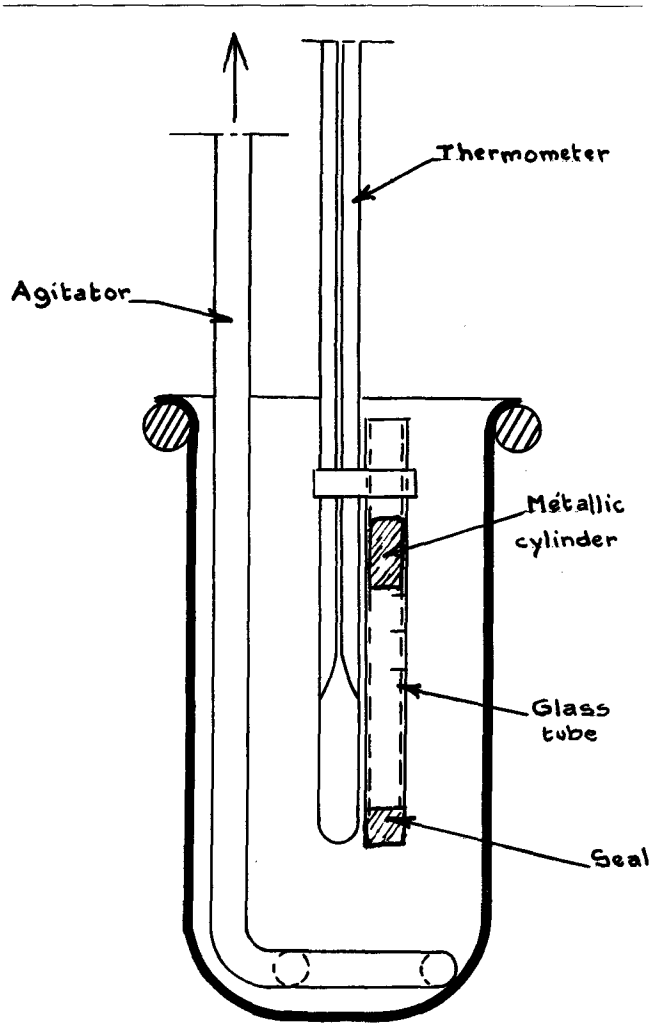

FIG. 1.

that it will have finished its course before complete liquefaction of the fat. Hence the harder the fat at ordinary temperature, the heavier must be the weight. When a series of samples is prepared in such a manner as increasingly to resemble a standard, it may be concluded that there is equality between the rate at which resemblance increases and the rate at which the cylinder-falling temperature of the samples approaches that of the standard.

Description of the Apparatus

The assembled parts of the apparatus are a modification of an apparatus for the determination of the melting point. Certain essential details are given in Figure 1. A thermometer with 0.1°C. divisions bears a small glass tube containing the fat and is immersed in a glycerine bath. Stirring of the latter is executed by hand by means of a glass circle raised and lowered alternately with an attached string. The glass tube, which is 60 mm. long and 3.5 mm. in inside diameter, is open at both ends and provided with a series of transverse marks, as indicated in the figure. It is filled to the upper mark, which is 10 mm. from the upper end, by immersing it in the fat (not fused previously), and then the lower end is sealed by a mastic prepared with calcium carbonate and linseed oil. Two lower marks engraved on the tube at distances of 15 and 20 mm. from the upper end serve, as described above, as reference marks for observation of the fall of the cylinder. The cylinder has a diameter slightly inferior to that of the tube; its length and accordingly its weight are chosen according to the type of the fat examined. In working with butter and butter substitutes lead cylinders of 2.5 mm. diameter and 10 mm. length were adopted.

Use of Apparatus

After the tube is filled to the upper mark and sealed from beneath as described above, the metallic cylinder is placed on the surface of the fat, and the tube is attached to the thermometer with a rubber band. Then the glycerine bath is heated gently with continuous stirring, and the temperatures are noted at which the cylinder a) leaves the upper mark, b) and c) passes by the following marks engraved on the glass tube, and d) touches the bottom formed by the seal.

Raising of the temperature is carried out always in the same manner at the rate of 1°C. per minute. Under these conditions the difference between duplicate determinations does not exceed 1°. Greater deviations, especially in the first reading, are caused by a too rapid approach to the starting temperature. The heating rate of 1° per minute should therefore be maintained 8 to 10 degrees under the presumed starting point. Some results obtained with butter and butter-like materials are shown in Table I.

A significant characteristic of a fat is the difference between the first and the second of the observed temperatures. Cacao butter has been included in the table to show that this difference is much reduced in fats having no plastic range; the difference is equally small or even smaller with palmkernel oil, coconut oil, etc.

As smooth raising of the temperature is of great importance, it is recommended that this be controlled by plotting a curve of time vs. temperature, as represented in Figure 2, where the four temperatures mentioned above are designated by the letters A, B, C, and D.

TABLE I

Consistencies of Butter-Like Fats

Sample	Temperatures (°C) observed at the passage of different marks on the cylinder				*Melting* point (capillary tube)
	Beginning of fall	First mark	Second mark	End	
					°C.
Cow's butter	29.5	31	31.3	31.5	37
Margarine, Astra	26	28.9	29.3	31	35.7
Cacao butter	31.4	32	32.1	32.3	34
Sample 186-4[a]	32.6	35.4	35.8	36.5	39.1
Sample 186-1a[a]	31	36	37.2	37.7	....

[a] "Tailor made" fats prepared by solvent fractionation of palm oil.

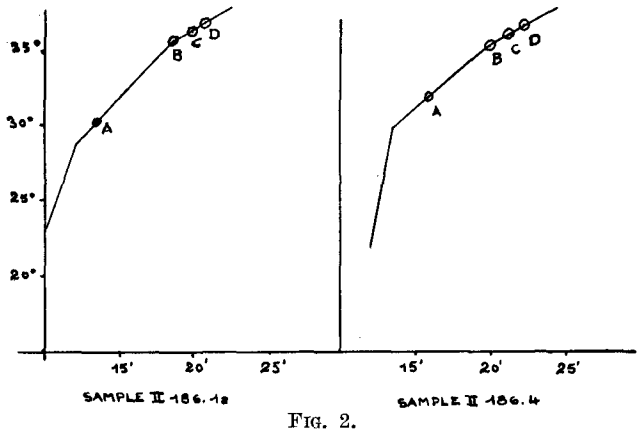

FIG. 2.

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