The mixtures were treated at three temperatures. Melting ice gave a temperature of 0° C. A mixture of ice and salt gave a temperature of −20° C. A temperature of −40° C. was obtained by mixing carbon dioxide with an excess of acetone in a Dewar flask.

At 0° C. the only mixture to solidify within a reasonable time of treatment was the 90 per cent mixture, which gave a recovery of 20 per cent. In each experiment the mixture was kept at the required temperature for 15 to 20 minutes with constant stirring. Furthermore, inoculation of the solution yielded no different results. At −20° C. results were obtained as shown in Table 23. At −40° C. results were obtained as shown in Table 24.

These results indicate that benzene crystals tend to include so much mother liquor that the freezing method for determining benzene is unreliable. It appears also that in the presence of an excess of nonaromatic constituents the benzene crystals may be either prevented from separating out or may be dissolved as soon as formed. In any event the freezing method seems to have little to recommend it. The tables (23 and 24) follow.

TABLE 23.—*Percentages of solids formed when benzene-gasoline mixtures were cooled to a temperature of −20° C.*

Test No.	Percentage of benzene in mixture.	Percentage, by volume, solidifying.
1	90	100
2	80	100
3	70	100
4	60	40
5	50	25
6	40	0
7	30	0
8	20	0
9	10	0

TABLE 24.—*Percentages of solids formed when benzene-gasoline mixtures were cooled to a temperature of −40° C.*

Test No.	Percentage of benzene in mixture.	Percentage, by volume, solidifying.
1	90	100
2	80	100
3	70	100
4	60	100
5	50	100
6	40	95
7	30	40
8	20	10
9	10	0

Previous considerations indicated that the most promising physical property on which to base an analytical method was specific gravity. By making use of the differences in gravities of aromatic and nonaromatic hydrocarbons boiling at the same temperatures it was possible to estimate with some accuracy the content of aromatic hydrocarbons. This method required a knowledge of the average specific gravity of nonaromatic constituents, and values were assumed that had been indicated as the result of much experience. In order to check these the aromatic content of various distillates was determined by the standard chemical method of nitration.[a] A close agreement was noted among results obtained by the two methods—the

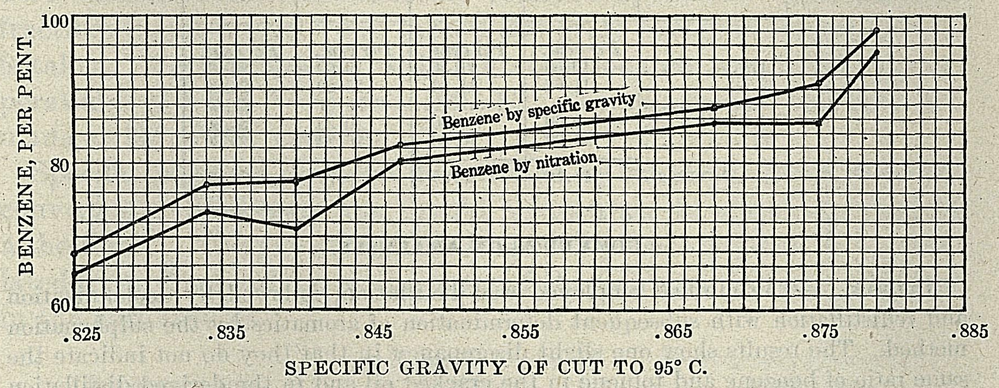

FIGURE 30.—Curves showing agreement of estimated percentages of benzene in cracked-oil distillates by the nitration and by the specific-gravity methods.

tedious one of nitration and the simple one of specific gravity. The results of the determinations appear in Table 25 and in figure 30

TABLE 25.—*Results of estimates of percentage of benzene present in various mixtures by the methods of specific gravity and nitration.*

Specific gravity of sample.	Percentage of benzene present.		Difference between values in columns 2 and 3.
	Estimated on basis of specific gravity.	Estimated on basis of nitration figures.	
1	2	3	4
0.824	65.0	63.6	1.4
.828	68.1	66.2	1.9
.840	75.0	72.0	3.0
.848	80.0	77.2	2.8
.867	91.9	88.0	3.9
.872	95.0	92.3	2.7
.878	98.8	96.0	2.8

In order to verify the results obtained in the course of this investigation four samples were sent to laboratories that specialize in the examination of hydrocarbon mixtures. These laboratories worked independently on samples of a cracked oil and on a distillation cut up to 200° C. obtained from the latter, the distillate representing

[a] Lunge, Georg, Coal tar and ammonia, 4th ed., vol. 2, 1909, p. 765.