MINES BRANCH,

DEPARTMENT OF MINES,

OTTAWA, CANADA.

GASOLINE SURVEY FOR 1928

By

P. V. Rosewarne & R. J. Offord.

Memorandum Series
No. 35
December, 1928.

MINES BRANCH,
DEPARTMENT OF MINES, OTTAWA, CANADA.

Memorandum Series: DECEMBER, 1928. No. 35

GASOLINE SURVEY FOR 1928

By

P. V. Rosewarne[1] and R. J. Offord[2].

The annual survey of the gasoline sold in Canada has been conducted by the Fuels and Fuel Testing Division of the Mines Branch during the past five years.[3] This report covers a similar survey for 1928. During the latter part of August, 77 samples were collected[4] from wholesalers or distributors in the following cities: Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, London, Winnipeg, Regina, Calgary, Edmonton, Vancouver, and Victoria. These samples were tested for distillation range and specific gravity. The distillation range was determined according to the method recommended by the United States Bureau of Mines.[5] From the results so obtained, a weighted index number was calculated after the method advocated by Gruse[6], with the difference that the index numbers were calculated from temperatures of the distillation range expressed in °F. instead of from temperatures expressed in °C. as was done by Gruse. The specific gravities were obtained by the Westphal balance at room temperature and the results calculated[7] to 60°F.

TABLE 1 - RESULTS OF ANALYSIS

Sample No.	Brand		DISTILLATION RANGE 1st Drop °F.	10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End Point °F.	Recovery	Index No. °F.	Specific Gravity
						HALIFAX, N.S.						
1.	Ethyl	(a)	122	178	200	261	302	360	420	97.5	1721	0.754
2.	Premier	(a)	115	166	194	260	306	360	408	97.5	1694	0.754
3.	Primrose	(b)	96	151	150	226	284	356	404	96.5	1551	0.719
Average:			111	158	181	249	297	559	411	97.2	1655	0.742
						ST. JOHN, N.B.						
4.	Premier	(a)	100	138	162	239	288	355	409	96.8	1591	0.724
5.	White Rose	(c)	104	152	178	258	304	369	425	97.0	1686	0.732
6.	Fundy	(d)	98	140	162	238	288	357	406	96.5	1591	0.723
Average:			101	143	167	245	293	360	413	96.8	1623	0.726
						QUEBEC						
7.	Red Seal	(c)	108	174	202	268	310	362	407	97.5	1723	0.745
8.	Peerless	(c)	104	150	172	234	270	329	377	98.0	1532	0.723
9.	Premier	(a)	112	170	203	270	314	368	412	98.0	1737	0;747
10.	Ethyl	(a)	119	178	201	260	300	358	408	98.0	1705	0.753
11.	Aviation	(f)	104	150	173	230	269	329	382	97.0	1533	0.720
Average:			109	164	190	252	293	349	397	97.7	1646	0.738
						MONTREAL						
12.	Premier	(a)	112	172	198	264	312	370	418	97.5	1734	0.746
13.	Marathon	(g)	108	169	197	262	309	372	425	97.8	1734	0.740
14.	Cyclo	(g)	102	158	186	276	333	392	420	97.0	1765	0.753
15.	Blue Sunoco	(h)	104	165	196	278	330	388	428	97.0	1787	0.758
16.	Peerless	(c)	105	153	176	236	277	340	387	97.3	1569	0.727
17.	Super-Power	(c)	108	167	197	270	312	368	413	97.5	1727	0.745
18.	Ethyl	(a)	120	170	192	270	318	372	422	98.0	1744	0.756
19.	Aviation	(f)	106	150	174	234	270	328	384	98.0	1540	0.722
Average:			108	163	190	261	308	366	412	97.5	1700	0.743

(a) Imperial Oil, Limited; (b) E. B. Boyd, Limited; (c) Canadian Oil Companies, Limited; (d) Canadian Independent Oil, Limited; (e) British American Oil Company, Limited; (f) Shell Oil Company, Limited; (g) McColl Frontenac Oil Company, Limited; (h) Sun Oil Company, Limited; (i) Cities Service Oil Company, Limited; (j) Supertest Petroleum Corporation; (k) Hull Iron and Steel; (m) Beach Motors; (n) Transport Oil Limited; (o) Dominion Oil Company; (p) Perfection Petroleum Company Limited; (q) J. T. Hayes; (r) Western Motor Corporation; (s) Prairie City Oil Company; (t) Western Oil Company; (u) North Star Oil and Refining Company, Limited; (v) Maple Leaf Oil and Refining Company, Limited; (w) Regal Oil and Refinery Company, Limited; (x) Alberta Refining Company, Limited; (y) General Petroleum Corporation; (z) Home Oil Distributors, Limited; (aa) Union Oil Company of Canada, Limited; (bb) Victoria Petroleum Company, Limited.

TABLE 1 - RESULTS OF ANALYSIS (CONT'D).

Sample No.	Brand		DISTILLATION RANGE 1st Drop °F.	10% °F.	20% °F	50% °F.	70% °F.	90% °F.	End Point °F.	Recovery.	Index No. °F.	Specific Gravity
						OTTAWA, ONT.						
20.	Sunoco (HT)	(h)	110	161	185	240	281	350	426	97.0	1643	0.726
21.	Premier	(a)	110	159	184	268	305	368	416	97.5	1698	0.746
22.	Cities-Ser(HT)	(i)	104	142	169	243	285	346	396	97.0	1581	0.720
23.	Ethyl	(a)	114	168	192	262	310	365	416	97.5	1713	0.736
24.	Red Seal	(c)	110	163	194	267	313	369	421	97.0	1727	0.741
25.	Supertest	(k)	114	165	191	265	310	369	418	98.0	1718	0.745
26.	Marathon	(g)	103	143	166	241	292	370	416	96.0	1628	0.724
27.	Super-Service	(l)	114	167	195	266	310	372	420	98.0	1730	0.747
28.	Peerless	(c)	105	150	174	237	278	341	385	96.7	1565	0.722
29.	Sunoco (LT)	(h)	113	161	184	247	288	353	403	97.3	1636	0.732
30.	Supertest (HC)	(k)	100	145	174	250	294	364	412	96.3	1659	0.731
31.	Cities-Ser(LT)	(i)	111	169	200	268	313	370	416	97.0	1736	0.744
32.	Aviation	(f)	106	147	168	225	264	324	372	97.0	1500	0.720
33.	Shell	(f)	105	145	166	224	267	325	370	96.8	1495	0.721
34.	White Rose	(c)	97	144	174	252	300	371	428	96.0	1669	0.728
35.	Super-Power	(c)	110	168	200	269	312	370	417	97.5	1736	0.745
36.	Beach (SQ)	(m)	104	141	160	221	260	324	395	97.4	1499	0.719
Average:			108	155	181	250	295	356	407	97.1	1642	0.734
						TORONTO, ONT.						
37.	Trail	(n)	103	150	173	240	284	352	401	97.0	1600	0.721
38.	Premier	(a)	116	172	200	268	315	370	417	97.0	1742	0.745
39.	Cities-Service	(i)	94	136	158	240	300	380	422	96.0	1636	0.723
40.	Shell	(f)	101	149	170	240	276	331	375	96.5	1549	0.720
41.	Blue Sunoco	(h)	98	148	176	270	326	386	420	97.0	1728	0.746
42.	Dominion	(o)	105	162	188	248	288	350	408	97.0	1644	0.721
43.	White Rose	(c)	107	165	195	261	307	370	429	97.0	1723	0.736
44.	Perfection	(p)	96	148	170	230	260	324	374	97.5	1506	0.722
Average:			102	153	180	250	294	358	406	96.8	1641	0.729
						LONDON, ONT.						
45.	Premier	(a)	100	166	196	270	310	366	410	97.5	1718	0.739
46.	Shell	(f)	103	154	165	246	288	360	452	97.0	1665	0.727
47.	Standard	(q)	96	160	212	278	320	366	412	98.0	1763	0.744
48.	Supertest	(k)	112	170	212	278	320	368	409	97.5	1765	0.745
49.	Super-Power	(c)	109	166	197	271	312	367	414	97.0	1727	0.736
50.	Marathon	(g)	94	139	164	240	288	360	410	97.0	1601	0.722
51.	White Rose	(c)	108	170	198	262	304	366	423	97.0	1725	0.736
52.	Staroline	(r)	100	148	170	230	262	310	364	98.0	1504	0.720
Average:			103	165	189	259	300	358	414	97.4	1684	0.734

TABLE 1 - RESULTS OF ANALYSIS (CONT'D).

Sample No.	Brand	1st Drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End Point °F.	Recovery	Index No. °F.	Specific Gravity
					WINNIPEG, MAN.						
53. Buffalo	(s)	106	168	198	268	308	362	406	98.0	1710	0.739
54. British Motor	(e)	112	178	208	274	315	367	411	98.0	1753	0.741
55. Sunbeam	(t)	100	154	180	248	294	358	406	97.5	1640	0.731
56. Ethyl	(a)	123	185	210	261	300	348	392	98.0	1696	0.741
57. North Star	(u)	104	160	182	246	290	354	412	97.0	1644	0.732
Average:		109	169	196	259	301	358	405	97.7	1689	0.737
					REGINA, SASK.						
58. Imperial	(a)	110	172	204	268	312	366	418	97.7	1740	0.742
59. British Motor	(e)	110	178	206	270	310	368	412	98.0	1744	0.744
60. White Rose	(c)	95	142	170	252	300	370	436	97.0	1670	0.730
61. North Star	(u)	112	139	150	186	216	278	364	98.0	1333	0.704
Average:		107	158	182	244	284	345	407	97.7	1622	0.730
					CALGARY, ALTA.						
62. Premier	(a)	106	165	195	261	308	367	418	97.0	1714	0.746
63. Maple Leaf	(v)	128	198	226	294	340	394	432	98.0	1884	0.745
64. Regal	(w)	110	168	190	252	296	356	406	98.0	1668	0.740
65. Sunshine	(x)	135	194	223	290	332	381	416	98.0	1836	0.750
Average:		120	181	208	274	319	374	418	97.7	1775	0.745
					EDMONTON, ALTA.						
66. Premier	(a)	108	160	186	258	300	364	414	98.0	1682	0.747
67. White Rose	(c)	104	162	190	260	302	362	413	97.5	1689	0.739
68. North Star	(u)	106	166	194	262	304	360	409	97.5	1695	0.742
69. British Motor	(e)	108	169	199	260	304	360	414	97.5	1706	0.740
Average:		106	164	192	260	302	361	412	97.6	1693	0.742
					VANCOUVER, B. C.						
70. General	(y)	99	159	196	274	326	388	426	97.0	1769	0.756
71. Northern Light	(z)	100	148	180	254	306	376	424	97.0	1688	0.744
72. Shell	(f)	110	168	197	261	305	362	404	98.0	1697	0.747
73. Three Star	(a)	96	146	180	250	292	357	412	97.0	1637	0.744
Average:		101	155	188	260	307	371	416	97.2	1698	0.748
					VICTORIA, B. C.						
74. Union	(aa)	96	148	180	250	294	356	409	97.0	1637	0.744
75. Three Star	(a)	104	154	184	250	292	348	402	97.5	1637	0.745
76. Shell	(f)	108	166	196	263	305	364	401	97.5	1695	0.747
77. Home	(bb)	100	152	183	250	293	354	414	97.0	1646	0.746
Average:		102	155	186	253	296	355	408	97.2	1654	0.745

TABLE 11 - AVERAGE RESULT OF ANALYSES BY CITIES.

District	1st Drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	90% °F.	96% °F.	End Point °F.	Recovery	Index No. °F.	Specific Gravity
Halifax, N.S.	111	158	181	249	297	359	411	97.2	1655	0.742
St. John, N.B.	101	143	167	245	293	360	413	96.8	1623	0.726
Quebec, P.Q.	109	164	190	252	293	349	397	9717	1646	0.738
Montreal, Que.	108	163	190	261	308	366	412	97.5	1700	0.743
Ottawa, Ont.	108	155	181	250	293	356	407	97.1	1642	0.734
Toronto, Ont.	102	153	180	250	294	358	406	96.8	1641	0.729
London, Ont.	103	163	189	259	300	358	414	97.4	1684	0.734
Winnipeg, Man.	109	169	196	259	301	358	405	97.7	1689	0.737
Regina, Sask.	107	158	182	244	284	345	407	97.7	1622	0.730
Calgary, Alta.	120	181	208	274	319	374	418	97.7	1775	0.745
Edmonton, Alta.	106	164	192	260	302	361	412	97.6	1693	0.742
Vancouver, B.C.	101	155	188	260	307	371	416	97.2	1698	0.748
Victoria, B.C.	102	155	186	253	296	355	408	97.2	1654	0.745
Average: [x]	107	160	186	255	298	359	409	97.3	1667	0.737

[x] This is the average value for all the samples tested.

Comparison of Results:-

It is quite interesting to compare the above figures with others obtained in somewhat the same way. Table 111 gives the average results of 88 samples collected in Canada, presumably in 1916, and reported by the laboratories of the Department of Inland Revenue[8]; the average of 48 samples collected in Canada during 1923[9]; the average of 59 samples collected in Canada during 1924[10]; the average of 73 samples collected during 1925[11]; the average of 76 samples collected during 1926[12]; the average of 83 samples collected during 1927[13]; the average of 77 samples collected during 1928; the average of 162 samples collected in United States during July, 1928, and reported by the U. S. Bureau of Mines[14], and the essential features of the specification for motor gasoline adopted by the Specification Board of the United States[15], for the use of the various departments and independent establishments of the United States Government. When judged by the distillation range, which is the ordinarily accepted standard, it will be observed that the gasoline sold in Canada during the present year shows an average of good quality, being superior to that sold during the three previous years, and very nearly equal to the average quality during 1924.

TABLE III - AVERAGE RESULTS FOR COMPARISON.

	DISTILLATION RANGE										
	1st Drop °F.	10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End Point °F.	Recovery	Index No. °F.	Specific Gravity	Iodine Value
Canada, 1916	125	170	192	237	270	330	380	--	1579	0.732	17
Canada, 1923	120	170	193	255	296	358	423	97.1	1695	0.737	19
Canada, 1924	113	173	195	249	288	347	410	97.4	1662	0.736	18
Canada, 1925	116	174	199	258	299	359	412	97.0	1701	0.739	18
Canada, 1926	110	164	191	256	300	360	410	97.4	1681	0.739	21
Canada, 1927	107	161	189	259	304	366	416	97.0	1693	0.741	--
Canada, 1928	107	160	186	255	298	359	409	97.3	1667	0.737	--
United States July, 1928	100	--	190	265	--	380	413	96.1	--	0.748	--
U.S. Federal Specification	131	--	221	284	--	392	437	--	--	--	---

TABLE IV - 10 PER CENT. OF SAMPLES HAVING MAXIMUM END POINT.

		DISTILLATION RANGE									
Sample No.	Brand	1st Drop °F.	10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End Point °F.	Recovery	Index No. °F.	Specific Gravity
46.	Shell	108	154	165	246	288	360	452	97.0	1665	0.727
60.	White Rose	95	142	170	252	300	370	436	97.0	1670	0.730
63.	Maple Leaf	128	198	226	294	340	394	432	98.0	1884	0.745
43.	White Rose	107	163	193	261	307	370	429	97.0	1723	0.736
15.	Blue Sunoco	104	165	198	278	330	388	428	97.0	1787	0.758
34.	White Rose	97	144	174	252	300	371	428	96.0	1669	0.728
20.	Sunoco (HT)	110	161	185	240	281	350	426	97.0	1643	0.726
70.	General	99	159	196	274	326	388	426	97.0	1769	0.756
Average:		106	161	188	262	309	374	432	97.0	1726	0.738

TABLE V - 10 PER CENT OF SAMPLES HAVING MINIMUM END POINT.

		DISTILLATION RANGE									
Sample No.	Brand	1st Drop °F.	10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End Point °F.	Recovery	Index No. °F.	Specific Gravity
61.	North Star	112	139	150	186	216	278	364	98.0	1333	0.704
33.	Shell	105	143	166	224	267	325	370	96.8	1495	0.721
32.	Aviation	106	147	168	225	264	324	372	97.0	1500	0.720
44.	Perfection	96	148	170	230	260	324	374	97.3	1506	0.722
40.	Shell	101	149	178	240	276	331	375	96.5	1549	0.720
8.	Peerless	104	150	172	234	270	329	377	98.0	1532	0.723
11.	Aviation	104	150	173	230	269	329	382	97.0	1533	0.720
52.	Staroline	100	148	170	230	262	310	384	98.0	1504	0.720
Average:		103	147	168	225	260	319	375	97.3	1494	0.719

In order to estimate the variations in quality of the gasoline being sold, the average of the 8 samples (approximately 10% of the total 77 samples) having the highest end point, and the average of the 8 samples having the lowest end point was obtained as in prededing years. The results are shown in Table IV and Table V.

Table VI - Difference between maximum and minimum end points.

	1916	August 1923	August 1924	August 1925	August 1926	August 1927	August 1928
Maximum 10%	432	446	459	458	437	438	432
Minimum 10%	322	381	358	366	379	380	375
Difference:	110	65	101	92	58	58	57

Table VI shows the difference between the average end points of the maximum 10% and minimum 10% of samples collected in Canada in 1916[16], 1923, 1924, 1925, 1926, 1927 and in 1928. The difference between the two averages has been used previously for the purpose of comparison, as a measure of the variation in quality. It will be observed that in 1928 the variation in quality, when determined by the above method, was practically the same as, although slightly less than, that obtained in the survey of 1926 and 1927.

Accordingly, an attempt was made to obtain a figure which would indicate more exactly the variations in quality. For that purpose the index number was chosen because it represents an aggregate of several points in the distillation range rather than the arbitrarily chosen end point. The procedure adopted was the same as that used above, namely, the average of ten per cent of the samples having the highest index numbers and the average of ten per cent of the samples having the lowest index numbers was calculated as shown in Tables VII and VIII.

TABLE VII - 10 PER CENT OF SAMPLES HAVING MAXIMUM INDEX NUMBERS.

Sample No.	Brand	Index No. °F.	Specific Gravity	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End Point
63.	Maple Leaf	1884	0.745	198	226	294	340	394	432
65.	Sunshine	1836	0.750	194	223	290	332	381	416
15.	Blue Sunoco	1787	0.758	165	198	278	330	388	428
70.	General	1769	0.756	159	196	274	326	388	426
47.	Standard	1768	0.744	160	212	278	320	366	412
14.	Cyclo	1765	0.753	158	186	276	333	393	420
48.	Supertest	1765	0.745	178	212	278	330	368	409
54.	British Motor	1753	0.741	178	208	274	315	367	411
Average:		1791	0.749	176	208	280	327	380	419

TABLE VIII - 10 PER CENT OF SAMPLES HAVING MINIMUM INDEX NUMBERS.

Sample No.	Brand	Index No. °F.	Specific Gravity	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End Point
61.	North Star	1333	0.704	139	150	186	216	278	364
33.	Shell	1495	0.721	143	166	224	267	325	370
36.	Beach (SQ)	1499	0.719	141	160	221	260	324	393
32.	Aviation	1500	0.720	147	168	225	264	324	372
52.	Starcline	1504	0.720	148	170	230	262	310	384
44.	Perfection	1506	0.722	148	170	230	260	324	374
6.	Peerless	1532	0.723	150	172	234	270	329	377
11.	Aviation	1535	0.720	150	173	230	269	329	382
Average:		1488	0.719	146	166	222	256	318	377

Similar calculations were made for samples collected and analyzed in preceding years and these results are shown in Table IX.

TABLE IX - DIFFERENCE BETWEEN MAXIMUM AND MINIMUM INDEX NUMBERS.

Year	1923	1924	1925	1926	1927	1928
Maximum 10%	1791	1806	1821	1815	1823	1791
Minimum 10%	1500	1428	1497	1524	1518	1488
Difference:	291	378	324	291	305	303

It will be seen that the variation in quality by this method of calculation shows a reasonably good agreement with that determined by the previous method, since the variation in quality was very slightly less during 1928 than that during 1927.

It will be further observed that the average index number of ten per cent of the samples having the highest index numbers of all those examined in 1928 was lower than an average index number calculated in like manner from the samples examined in the three previous years. This indicates that the average volatility of that group of samples was greater in 1928 than in 1927, 1926 and 1925. Similarily, it is also to be noted that the average index number of ten per cent of the samples having the lowest index numbers of those examined in 1928 was lower than an average index number calculated in like manner from the samples examined in the three previous years. This indicates that the average volatility of this group also was greater in 1928 than in 1927, 1926 and 1925. Accordingly, it may be said that the lowest and the highest grades of the samples examined in 1928 were more volatile than similar grades of the samples examined in 1927, 1926 and 1925.

LIST OF REFERENCES

1. Engineer in charge of Oil and Gas Section, Division of Fuels and Fuel Testing, Mines Branch.
2. Junior Chemist, Division of Fuels and Fuel Testing, Mines Branch.
3. Investigations of Fuels and Fuel Testing, Mines Branch 1923 to 1926 inclusive, and Memorandum Series No. 31.
4. The hearty support and co-operation of the Department of Health in taking samples is gratefully acknowledged.
5. U. S. Bureau of Mines, Technical Paper 323B.
6. Chemical and Metallurgical Engineering, Vol. 29, No. 22, page 970. Investigations of Fuels and Fuel Testing, Mines Branch, 1923, page 53.
7. U. S. Bureau of Standards, Circular 57.
8. Department of Inland Revenue, Canada, Bulletin No. 362 ("Gasoline").
9. Investigations of Fuels and Fuel Testing, Mines Branch, 1923.
10. Investigations of Fuels and Fuel Testing, Mines Branch, 1924.
11. Investigations of Fuels and Fuel Testing, Mines Branch, 1925.
12. Investigations of Fuels and Fuel Testing, Mines Branch, 1926.
13. Mines Branch, Department of Mines, Canada, Memorandum Series No. 31.
14. U. S. Bureau of Mines, Report of Investigations, Serial No. 2887.
15. U. S. Bureau of Mines, Technical Paper, 323B.
16. Investigations of Fuels and Fuel Testing, Mines Branch, 1923.

- Summary -

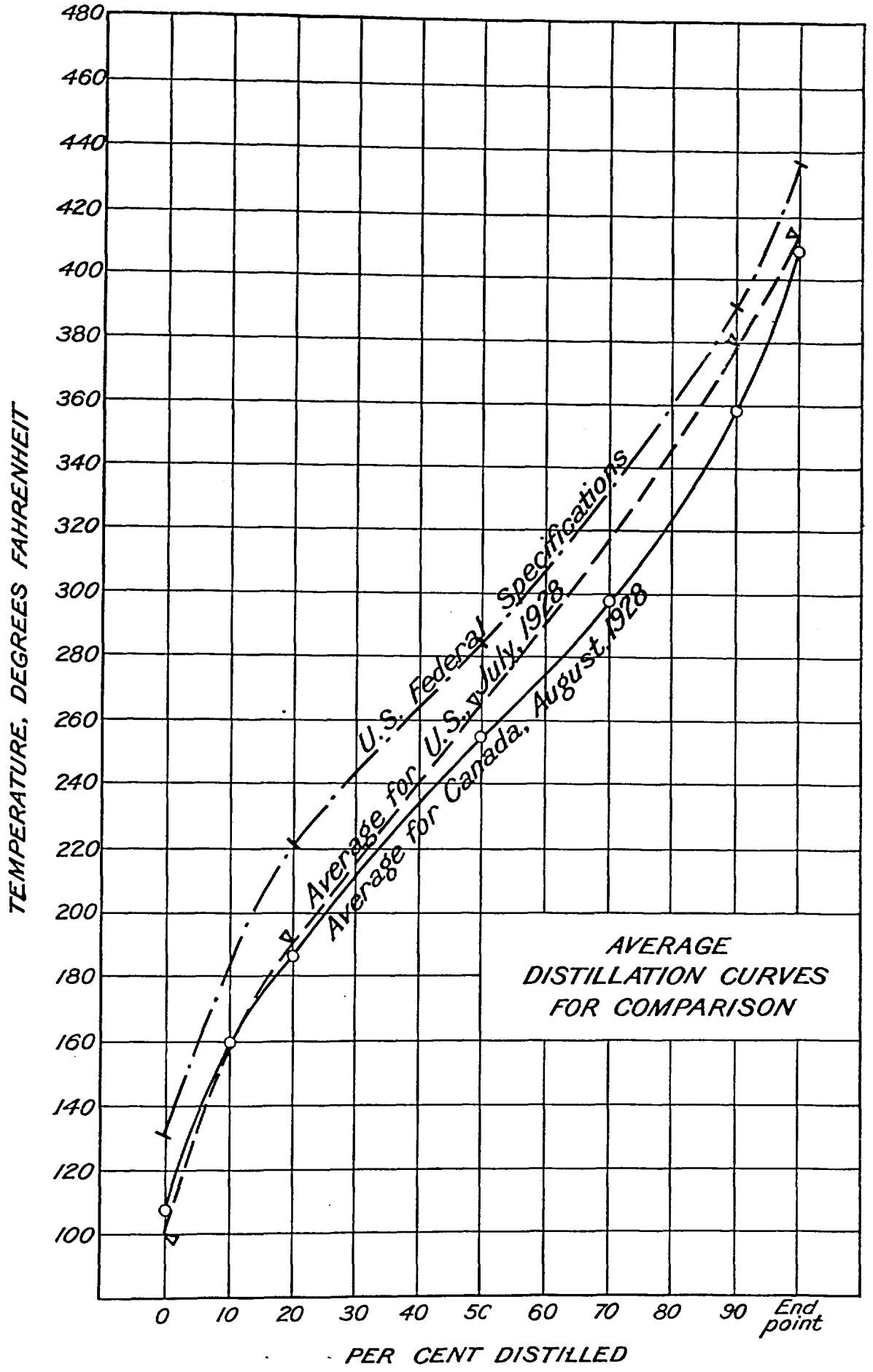
Seventy-seven samples of gasoline were collected in August, 1928, from thirteen widely separated Canadian cities, and may be accepted, therefore, as representative of the gasoline sold in Canada at that time.

The analyses and detailed examinations show that the average gasoline sold during 1928 was of good quality, being superior to that sold during the three previous years, and very nearly equal to the average quality during 1924.

The variation in quality during 1928 was very slightly less than that during 1927.

The lowest and the highest grades of the samples examined in 1928 were more volatile than similar grades of the samples examined in 1927, 1926 and 1925.

According to the distillation curves and other data, the gasoline marketed in Canada during August, 1928, was superior to that sold in United States during July, 1928, and to the United States Federal Specifications for the United States Government motor gasoline


TEMPERATURE, DEGREES FAHRENHEIT
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
0
10
20
30
40
50
60
70
80
90
End point
PER CENT DISTILLED
U.S. Federal Specifications
Average for U.S., July, 1928
Average for Canada, August, 1928
AVERAGE DISTILLATION CURVES FOR COMPARISON