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DEPARTMENT OF MINES

OTTAWA, CANADA

GASOLINE SURVEY FOR 1930

by

H. McD. Chantler

Memorandum Series
No. 45
January, 1931.

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GASOLINE SURVEY FOR 1930

By

H. McD. Chantler[1]

The annual survey of the gasoline sold in Canada has been conducted by the Division of Fuels and Fuel Testing of the Mines Branch during the past seven years[2]. This report covers a similar survey for the year 1930. During the early part of August, 124 samples were collected[3] from wholesalers or distributors in the following cities: Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, London, Winnipeg, Regina, Edmonton, Calgary, Vancouver and Victoria. The distillation range and specific gravity were determined for these samples.

The distillation range was tested according to the standard method designated as D86-27 by the American Society for Testing Materials. From the results so obtained, a weighted index number was calculated after the method advocated by Gruse[4]. By this method the temperature readings at which 10, 20, 50, 70 and 90 per cent of the distillate has been recovered are added to the temperature reading at the end point of the distillation and the resultant sum is called the "index number". The index numbers shown in this report were calculated from the temperatures of the distillation range expressed in degrees Fahrenheit instead of in degrees Centigrade as was done by Gruse. The specific gravity was obtained by the use of the Chainomatic specific gravity balance at room

temperature, and the result calculated to 60° F. according to the National Standard Petroleum Oil Tables, published by the United States Bureau of Standards Standards[5]. The specific gravity has been expressed also according to a system in general use in the petroleum industry. This system used to be called the "Baume" scale, but, due to some uncertainty regarding the correct reference points, two slightly different scales came into use, both of them, unfortunately, being called Baume scales. The American Petroleum Institute with the coöperation of U. S. Government departments and of the petroleum industry adopted one of these scales and described it in such a way that no ambiguity is possible. In order to avoid confusion the initials of the American Petroleum Institute were chosen to designate this scale, and it is therefore referred to as the A.P.I. scale. The scale is divided into 100 main divisions called degrees, the 10 degree point being equivalent to the specific gravity of pure water. The degrees A.P.I. have nearly the same value in specific gravity as the older Baume degrees. The greatest difference occurs at the upper end of the scale and is always less than one degree. The relation between degrees A.P.I. and specific gravity is expressed by the equation:

$$\text{Degrees A.P.I.} = \frac{141.5}{\text{Sp. Gr. at } 60^{\circ}\text{F.}} - 131.5$$

The degrees A.P.I. given in this report were obtained by converting the specific gravities according to National Standard Petroleum Oil Tables referred to above.

The results of analysis are given in Table I and the average results of analyses by cities are shown in Table II.

Significance of Tests on Gasoline.

Laboratory analyses are most valuable when they serve to indicate probable performance under operating conditions, hence an attempt is herewith made to interpret along that line some of the analytical results given below. The owner of the engine is the final judge of the quality of a motor fuel and he reaches his conclusions from the general responsiveness of the engine. It is obvious that the criteria for quality in motor fuels are changed just as rapidly as the engines are being changed. It appears to the writer that new and desirable characteristics in fuels must not only show at their best in the new engines, but they must also operate the old ones without serious difficulty.

Since the average life of an automobile is about five years, a satisfactory fuel from the standpoint of the general public must necessarily be somewhat different from the best fuel on the proving grounds of the motor manufacturer. The comments on quality of gasoline in relation to laboratory analysis given below, are, therefore, to be understood as being offered from the standpoint of the average owner of an automobile.

A good gasoline should possess the following characteristics: Should permit the engine to start easily; should permit the engine to develop maximum power; should allow the engine to run evenly when throttled down and should not stall; should not "knock"; should not evaporate too readily at atmospheric temperatures; should not contain sufficient gum to cause sticking valves.

Relation of distillation range data to easy starting, maximum power, and idling.

A gasoline that permits an engine to start readily should have a reasonably low initial boiling point, about 100°F. is satisfactory under normal atmospheric temperatures, and the temperature at which 10% has been recovered, as indicated by the distillation range data, should also be reasonably low, about 150°F. would probably give good results. This provides for a reasonable quantity of highly volatile material that will ignite easily.

Maximum power will be secured from an engine when the carburetor supplies it with an even mixture of gasoline vapour and air which can be, and is, properly burned. The gasoline vapours should not carry too much material of high boiling point because such material is usually more difficult to ignite. Neither should it contain too much low boiling material because such material will burn so rapidly that the engine cannot convert it efficiently into useful work. Therefore, the gasoline should be composed of a series of constituents with gradually increasing boiling points, as indicated by a smooth, gradually rising, distillation range curve. A gasoline that will permit an engine to start readily should also permit satisfactory power development provided the distillation range shows 70% over at about 300°F. In addition, the end point should not be too high.

Smooth running at low speed is seemingly more dependent on the design and condition of the engine and accessories than on the fuel used. However, the volatility of the fuel as a whole should not be so high as to cause it to vaporize or boil in the gasoline lines or carburetor. Obviously, the placing of the parts, the temperature of the engine, and the temperature of the atmosphere will have considerable effect.

Index number and specific gravity

The index number may be used as a convenient indicator of the volatility of a gasoline, since it is the sum of several points in the distillation range. Generally speaking, the smaller the index number the greater the volatility of the fuel. Gasolines may be classified with more or less arbitrary dividing lines, according to their index numbers, into three groups, viz.,

(a) those with values less than 1650 with comparatively high volatility,

(b) gasolines with average volatility coming between 1650 and 1725, and

(c) the low volatile gasolines having index numbers greater than 1725.

Although the specific gravity of gasoline has been used for many years as a test of its quality, at the present time it is not of very much value, because gasolines may be so mixed or blended as to give widely varying desired qualities. It may be used as an aid, however, in interpreting the results of the distillation range test, particularly with the increased use of gasoline from natural gas and cracked gasoline for blending.

Antiknock qualities

Some fuels have mixed with them certain chemicals such as tetra-ethyl lead, that lessen the tendency of the fuel to cause "knocking". These fuels require elaborate equipment to determine the actual antiknock value, the results from which equipment were not available for this report. Other fuels that have not been prepared by the addition of antiknock compounds show rather wide variations in this respect. Generally speaking, it may be assumed that gasolines having a high percentage of aromatics and unsaturates[6] will knock less than fuels having a low percentage, providing the gasolines contain no artificially mixed antiknock compounds.

Evaporation and gum

The readiness with which a gasoline evaporates is indicated by the amount of the recovery after distillation. When the recovery is less than 95% the evaporation loss is likely to be excessive. It is very difficult to determine the amount of gum in gasolines in such a manner that definite limits can be set. This is due to the fact that the character and amount of the gum varies greatly in different gasolines. A gasoline may show no gum formation when freshly distilled, but at some later time definite gummy deposits may be obtained. The time and the conditions required for the gum deposits to form also vary greatly. It is believed that unsaturates are more likely to cause gum than any of the other constituents.

The writer desires to emphasize again that the opinions expressed above regarding desirable characteristics for gasoline when used for motor fuel are from the standpoint of the average motor car owner during the summer. It is understood, of course, that atmospheric changes of temperature and pressure would cause considerable modification of the figures.

TABLE I - RESULTS OF ANALYSIS

Sample No.	Brand	Company	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss	Index No. °F.	Spec. grav.	Deg. API.
									HALIFAX, N.S.						
1.	Sunoco	(a)	97	156	197	281	333	389	423	97.0	1.2	1.8	1779	0.762	54.2
2.	Primrose	(b)	90	137	168	258	312	366	401	97.0	1.0	2.0	1640	0.741	59.5
3.	Premier	(c)	97	167	197	272	314	365	395	96.5	1.0	2.5	1710	0.747	57.9
4.	White Rose	(d)	98	151	179	247	294	353	412	97.0	1.2	1.8	1636	0.733	61.5
5.	Cyclo	(e)	98	146	177	267	329	387	419	97.5	1.2	1.3	1725	0.757	55.4
	Average:		96	151	184	265	316	372	410	97.0	1.1	1.9	1698	0.748	57.7
									ST.JOHN, N.B.						
6.	Fundy	(f)	103	173	199	267	307	358	393	96.5	1.0	2.5	1697	0.747	57.9
7.	No-Nox	(g)	98	148	171	228	263	313	365	97.5	1.0	1.5	1488	0.730	62.3
8.	Premier	(h)	100	170	200	264	305	355	392	97.0	1.1	1.9	1686	0.746	58.2
9.	Marathon H.T.	(e)	106	169	201	268	306	356	393	98.0	1.1	0.9	1693	0.747	57.9
10.	White Rose	(d)	95	149	181	255	296	352	400	97.5	1.0	1.5	1633	0.735	61.0
	Average:		100	162	190	256	295	347	389	97.3	1.0	1.7	1639	0.741	59.5
									QUEBEC, QUE.						
11.	Super Shell	(h)	95	141	168	248	308	374	413	97.5	1.0	1.5	1652	0.738	60.2
12.	Super Power	(i)	100	166	193	261	304	368	410	97.5	1.2	1.3	1702	0.748	57.7
13.	Premier	(c)	103	172	200	262	301	350	390	97.5	0.9	1.6	1675	0.748	57.7
14.	White Rose	(d)	94	138	163	248	299	368	413	97.0	1.1	1.9	1629	0.736	60.8
15.	Peerless	(i)	93	135	160	230	279	348	385	96.5	1.1	2.4	1537	0.720	65.0
16.	Imperial Ethyl	(c)	100	159	188	256	301	358	405	97.5	1.1	1.4	1667	0.750	57.2
	Average:		97	152	179	251	299	361	402	97.3	1.1	1.6	1644	0.740	59.8

TABLE I - RESULTS OF ANALYSIS (Cont'd).

Sample No.	Brand	Company	1st drop °F.	10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss	Index No. °F.	Spec. grav.	Deg. API.
									MONTREAL, QUE.						
17.	Super Power	(i)	100	163	194	263	305	369	412	97.5	1.0	1.5	1706	0.747	57.9
18.	Imperial Ethyl	(c)	106	165	191	267	313	374	415	97.0	1.0	2.0	1725	0.754	56.2
19.	Premier	(c)	99	159	194	275	325	384	416	97.0	1.1	1.9	1753	0.750	57.2
20.	Marathon	(e)	98	170	198	264	314	374	417	98.0	1.2	0.8	1737	0.743	58.9
21.	Blue Sunoco	(a)	102	160	196	281	331	389	423	97.5	1.0	1.5	1780	0.761	54.4
22.	Cyclo	(e)	106	161	189	282	337	390	420	97.0	1.1	1.9	1779	0.772	51.8
23.	Super Shell	(h)	96	138	161	238	294	365	406	97.0	1.1	1.9	1602	0.734	61.3
24.	Shell	(h)	108	162	195	293	347	397	427	96.5	1.0	2.5	1821	0.750	57.2
25.	Peerless	(i)	99	147	174	249	303	378	418	96.5	1.1	2.4	1669	0.732	61.8
26.	Supertest	(j)	104	162	198	279	326	378	410	97.0	1.2	1.8	1753	0.757	55.4
	Average:		101	159	189	269	320	380	416	97.1	1.1	1.8	1733	0.750	57.2

Company

(a) Sun Oil of Canada, Limited.
(b) Irving Oil Company, Limited.
(c) Imperial Oil, Limited
(d) Canadian Oil Companies, Limited.
(e) McColl-Frontenac Oil Company, Limited
(f) Canadian Independent Oil, Limited.
(g) Gulf Refining Company, Limited.
(h) Shell Company of Canada, Limited.
(i) British American Oil Company, Limited.
(j) Supertest Petroleum Corporation
(k) Beach Motors, Limited.
(l) Super Service Gas & Oil Company, Limited.
(m) Domestic Storage & Forwarding Company, Ltd.
(n) Cities Service Oil Company, Limited.
(o) Perfection Petroleum Company, Limited.
(p) High Grade Oil Company, Limited.
(q) Transport Oil Company, Limited.
(r) White Star Refining Company, Limited.
(s) Erie Oil Company, Limited.
(t) Thayers Limited.
(u) Prairie Cities Oil Company, Limited.
(v) North Star Oil & Refining Company, Limited.
(w) Puritan Oil Company, Limited.
(x) Union Oil Company of Canada, Limited.
(y) Maple Leaf Oil & Refining Company, Limited.
(z)) Regal Oil & Refining Company, Limited (Regal Distributors).
(aa) Texas Company of Canada, Limited.
(bb) C. C. Snowden.
(cc) Northern Oil Company, Limited.
(dd) Richfield Oil Distributors, Limited.
(ee) Shell Company of California, Limited.
(ff) Home Oil Distributors, Limited.
(gg) General Oil Company, Limited.

TABLE I - RESULTS OF ANALYSIS (Cont'd).

Sample No.	Brand	Company	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss	Index No. °F.	Spec. grav.	Deg. API
									OTTAWA, ONT.						
27.	Super Power	(i)	106	162	196	274	319	376	412	97.0	1.0	2.0	1739	0.751	56.9
28.	Peerless	(i)	97	138	165	243	303	382	423	96.5	1.1	2.4	1654	0.729	62.6
29.	B. A. Ethyl	(i)	98	168	194	260	304	368	412	97.0	1.0	2.0	1706	0.753	56.4
30.	Supertest	(j)	100	154	189	274	322	376	409	97.0	1.1	1.9	1724	0.754	56.2
31.	Supertest H.C.	(j)	94	130	152	225	277	347	399	97.0	1.2	1.8	1530	0.720	65.0
32.	Blue Sunoco	(k)	99	156	193	281	332	391	421	97.0	1.2	1.8	1774	0.765	53.5
33.	Super Quality	(k)	92	124	146	215	270	346	398	96.5	1.1	2.4	1499	0.719	65.3
34.	Super Servic e	(l)	101	149	172	236	276	322	366	97.0	1.1	1.9	1521	0.716	66.1
35.	C hampion Domestic	(m)	92	132	154	235	284	346	394	96.5	1.0	2.5	1545	0.722	64.5
36.	Noxless	(m)	92	132	157	248	316	393	419	96.5	1.2	2.3	1665	0.738	60.2
37.	Champion Ethyl.	(m)	98	160	188	258	307	368	412	97.5	1.2	1.3	1693	0.747	57.9
38.	Shell	(h)	106	164	196	290	344	394	426	97.0	1.3	1.7	1814	0.752	56.7
39.	Super Shell	(h)	96	140	163	241	294	364	408	97.5	1.0	1.5	1610	0.735	61.0
40.	Cities Service	(n)	95	152	183	265	320	380	408	96.5	1.2	2.3	1708	0.736	60.8
41.	Koolmotor	(n)	90	124	146	218	269	329	374	97.0	1.0	2.0	1460	0.722	64.5
42.	Premier	(c)	104	160	192	270	318	374	413	97.0	1.1	1.9	1727	0.750	57.2
43.	Imperial Ethyl	(c)	106	160	191	262	314	372	412	97.5	1.2	1.3	1711	0.752	56.7
44.	Marathon	(e)	112	170	195	261	309	374	418	97.0	1.2	1.8	1727	0.743	58.9
45.	Cyclo	(e)	110	164	193	284	340	391	418	97.0	1.0	2.0	1790	0.784	49.0
46.	Red Seal	(d)	104	148	180	262	312	374	414	97.0	1.0	2.0	1690	0.744	58.7
47.	White Rose	(d)	95	134	160	251	308	372	409	97.0	1.2	1.8	1634	0.735	61.0
48.	Canadian Ethyl	(d)	104	148	175	252	300	368	413	97.0	1.0	2.0	1656	0.743	58.9
	Av erage:		100	149	176	255	306	368	408	97.0	1.1	1.9	1662	0.741	59.5

TABLE I - RESULTS OF ANALYSIS (Cont'd).

Sample No.	Brand	Company	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss	Index No. °F.	Spec. grav.	Deg. API.
									TORONTO, ONT.						
49.	Premier	(c)	98	160	192	274	320	376	410	97.5	1.1	1.4	1732	0.743	58.9
50.	Domestic	(m)	96	143	170	236	282	349	396	96.5	1.0	2.5	1576	0.726	63.4
51.	Cities Service	(n)	97	140	167	248	304	375	404	97.0	1.0	2.0	1638	0.729	62.6
52.	Perfection	(o)	104	158	194	283	334	392	420	97.0	1.2	1.8	1781	0.747	57.9
53.	Super High Grade	(p)	104	148	168	218	248	295	364	97.5	1.0	1.5	1441	0.721	64.8
54.	Shell	(h)	107	162	198	272	318	371	393	97.0	1.2	1.8	1714	0.746	58.2
55.	Trail Gas	(q)	104	160	186	257	310	378	421	97.5	1.0	1.5	1712	0.739	60.0
56.	Marathon	(e)	101	150	182	273	332	392	412	96.5	1.1	2.4	1741	0.738	60.2
57.	Super Power	(i)	100	157	185	256	305	365	398	96.5	1.0	2.5	1666	0.736	60.8
58.	Red Seal	(d)	105	165	189	256	301	366	416	97.0	1.4	1.6	1693	0.736	60.8
	Average:		102	154	183	258	305	366	403	97.0	1.1	1.9	1669	0.736	60.8
									LONDON, ONT.						
59.	Blue Sunoco	(a)	104	168	200	284	332	390	424	97.0	1.2	1.8	1798	0.765	53.5
60.	Regular	(r)	92	136	160	234	279	350	402	96.5	1.1	2.5	1561	0.721	64.8
61.	Super Shell	(h)	92	142	168	244	286	340	378	97.0	1.0	2.0	1558	0.736	60.8
62.	Marathon	(e)	96	146	173	245	299	375	415	97.0	1.2	1.8	1653	0.732	61.8
63.	Erie Oil Co.	(s)	105	175	212	292	331	377	416	97.0	1.0	2.0	1803	0.750	57.2
64.	Super Power	(i)	108	162	190	266	313	372	410	97.0	1.1	1.9	1713	0.740	59.7
65.	Premier	(c)	102	164	196	274	324	376	408	97.0	1.0	2.0	1742	0.741	59.5
66.	Standard	(t)	100	160	190	260	302	360	400	97.0	1.0	2.0	1672	0.738	60.2
	Average:		100	157	186	262	308	368	407	96.9	1.1	2.0	1688	0.740	59.7

TABLE I - RESULTS OF ANALYSIS (Cont'd).

Sample No.	Brand.	Company	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss	Index No. °F.	Spec. grav.	Deg. API.
									WINNIPEG, MAN.						
67.	Red Seal	(d)	102	168	200	273	322	376	414	97.5	1.0	1.5	1753	0.743	58.9
68.	Marathon	(e)	91	138	164	234	276	341	392	97.0	1.0	2.0	1545	0.721	64.8
69.	Imperial Ethyl	(c)	96	155	182	252	294	350	398	97.5	1.0	1.5	1631	0.733	61.5
70.	Super Power	(i)	106	170	202	277	321	375	414	97.0	1.1	1.9	1759	0.745	58.4
71.	Electro	(u)	104	156	176	232	270	324	376	98.0	1.0	1.0	1534	0.724	63.9
72.	North Star Ethyl	(v)	110	169	197	261	301	356	405	98.0	1.2	0.8	1689	0.745	58.4
	Average:		101	159	187	255	297	354	400	97.5	1.1	1.4	1652	0.735	61.0
									REGINA, SASK.						
73.	Marathon	(e)	100	143	166	230	272	335	390	97.0	1.0	2.0	1536	0.722	64.5
74.	Premier	(c)	100	158	190	264	310	362	398	97.5	1.0	1.5	1682	0.739	60.0
75.	White Rose	(d)	104	168	194	259	302	365	410	97.5	1.0	1.5	1698	0.739	60.0
76.	Maple Leaf	(w)	105	150	170	222	261	326	378	97.0	1.0	2.0	1507	0.717	65.9
77.	Super Power	(i)	106	166	194	268	310	362	400	97.0	1.0	2.0	1700	0.740	59.7
	Average:		103	157	183	249	291	350	395	97.2	1.0	1.8	1625	0.731	62.0

TABLE I - RESULTS OF ANALYSIS (Cont'd).

Sample No.	Brand	Company	DISTILLATION RANGE 1st drop °F.	10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss	Index No. °F.	Spec. grav.	Deg. API.
						CALGARY, ALTA.									
78.	Imperial Ethyl	(c)	104	156	186	259	302	361	407	97.5	1.1	1.4	1671	0.747	57.9
79.	Premier	(c)	98	158	185	262	308	364	407	97.0	1.2	1.8	1684	0.747	57.9
80.	White Rose	(d)	108	146	172	246	298	371	423	97.0	1.2	1.8	1656	0.735	61.0
81.	Red Seal	(d)	102	154	176	246	298	372	422	98.0	1.1	0.9	1668	0.736	60.8
82.	Canadian Ethyl	(d)	115	162	189	259	300	364	414	97.5	1.2	1.3	1688	0.749	57.4
83.	Union	(x)	108	165	190	250	296	360	404	97.0	1.1	1.9	1665	0.753	56.4
84.	Union Ethyl	(x)	105	162	188	242	279	337	399	97.5	1.0	1.5	1607	0.748	57.7
85.	Maple Leaf	(y)	110	166	189	250	290	348	394	98.0	1.0	1.0	1637	0.737	60.5
86.	Hyspd	(y)	112	163	192	266	318	375	410	97.5	1.2	1.3	1724	0.742	59.2
87.	Regal	(z)	96	140	156	207	252	349	412	97.5	1.3	1.2	1507	0.717	65.9
88.	Regal Ethyl	(z)	97	142	159	209	250	336	396	97.5	1.1	1.4	1492	0.720	65.0
89.	Super Power	(i)	100	150	172	244	297	370	419	98.0	1.4	0.6	1652	0.735	61.0
90.	B. A. Ethyl	(i)	104	158	187	260	303	358	405	98.0	1.2	0.8	1671	0.749	57.4
91.	Texaco	(aa)	100	158	188	275	326	375	400	98.0	1.1	0.9	1722	0.741	59.5
92.	Texaco Ethyl	(aa)	104	159	190	277	326	372	396	98.0	1.2	0.8	1720	0.744	58.7
93.	Energy	(bb)	99	148	165	219	265	358	424	98.0	1.2	0.8	1579	0.725	63.7
94.	North Star	(v)	102	152	176	248	297	372	420	97.5	1.1	1.4	1665	0.737	60.5
95.	High Life Motor	(v)	96	139	159	213	259	343	393	97.0	1.1	1.9	1506	0.720	65.0
96.	North Star Ethyl	(v)	107	158	188	263	307	364	408	97.0	1.2	1.8	1688	0.748	57.7
97.	Marathon H.T.	(e)	101	154	178	246	293	351	396	97.0	1.1	1.9	1618	0.733	61.5
	Average:		103	155	180	247	293	359	407	97.5	1.2	1.3	1641	0.738	60.2

TABLE I - RESULTS OF AN ALYSIS (Cont'd).

Sample No.	Brand	Com-pany	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Reco-very	Resi-due	Distil-lation loss	Index Index °F.	Spec. grav.	Deg. API.
									EDMONTON, ALTA.						
98.	Regal	(z)	101	138	156	206	247	333	404	97.5	1.1	1.4	1484	0.718	65.6
99.	Regal Ethyl	(z)	110	153	166	208	242	309	388	98.0	1.0	1.0	1466	0.723	64.2
100.	B. A. Ethyl	(i)	107	166	192	263	306	362	404	97.0	1.3	1.7	1693	0.750	57.2
101.	Super Power	(i)	110	155	176	245	300	374	420	97.0	1.2	1.8	1670	0.737	60.5
102.	Premier	(c)	106	161	187	262	303	362	407	97.0	1.1	1.9	1680	0.747	57.9
103.	Imperial Ethyl	(c)	104	161	190	264	310	366	404	96.5	1.1	2.4	1695	0.749	57.4
104.	Texaco	(aa)	106	159	189	278	328	380	404	97.0	1.1	1.9	1738	0.740	59.7
105.	Union	(x)	106	165	188	249	294	360	406	97.0	1.0	2.0	1662	0.751	56.9
106.	Marathon H.T.	(e)	109	169	196	266	311	375	410	96.5	1.0	2.5	1727	0.742	59.2
107.	North Star	(v)	106	154	174	245	299	378	422	97.0	1.2	1.8	1672	0.736	60.8
108.	High Life	(v)	106	130	140	173	209	285	393	97.5	1.3	1.2	1330	0.697	71.5
109.	North Star Ethyl	(v)	108	160	190	261	305	365	410	97.5	1.0	1.5	1691	0.748	57.7
110.	Maple Leaf	(y)	121	181	203	259	294	345	396	97.5	1.0	1.5	1678	0.740	59.7
111.	White Rose	(d)	114	152	178	248	303	374	423	97.5	1.0	1.5	1678	0.737	60.5
112.	Canadian Ethyl	(d)	110	159	187	258	301	363	414	97.5	1.4	1.1	1682	0.747	57.9
113.	Red Seal	(d)	98	156	176	248	300	373	419	97.5	1.1	1.4	1672	0.737	60.5
114.	Noroco	(cc)	97	139	157	205	243	326	400	97.5	1.2	1.3	1470	0.717	65.9
	Average:		107	157	179	243	288	355	407	97.2	1.1	1.7	1629	0.736	60.8

TABLE I - RESULTS OF ANALYSIS (Cont'd).

Sample No.	Brand	Company	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss.	Index No. °F.	Spec. grav.	Deg. API
									VANCOUVER, B.C.						
115.	Richfield	(dd)	103	170	204	276	320	380	418	98.0	1.2	0.8	1768	0.759	54.9
116.	Union	(x)	102	158	187	245	288	348	404	97.5	1.1	1.4	1630	0.750	57.2
117.	Premier	(c)	110	166	190	248	290	346	404	98.0	1.0	1.0	1644	0.752	56.7
118.	Shell (400)	(ee)	106	164	192	252	294	356	398	97.5	1.0	1.5	1656	0.750	57.2
119.	Home	(ff)	100	160	186	254	298	364	418	98.0	1.0	1.0	1680	0.751	56.9
120.	Violet Ray	(gg)	101	157	190	254	297	369	415	97.0	1.0	2.0	1682	0.752	56.7
	Average:		104	163	192	255	298	360	409	97.7	1.1	1.2	1677	0.752	56.7
									VICTORIA, B.C.						
121.	Union	(x)	100	162	188	252	298	360	406	98.0	1.2	0.8	1666	0.752	56.7
122.	Shell (400)	(ee)	106	162	193	250	290	355	398	98.0	1.0	1.0	1648	0.748	57.7
123.	Home Gas	(ff)	99	162	186	239	284	342	394	98.0	1.0	1.0	1607	0.749	57.4
124.	3 Star Premier	(c)	105	164	194	253	299	361	409	97.0	1.1	2.0	1680	0.752	56.7
	Average:		103	162	190	249	293	354	402	97.7	1.1	1.2	1650	0.750	57.2

TABLE II - AVERAGE RESULTS OF ANALYSES BY CITIES

District	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss	Index No. °F.	Spec. grav.	Deg. API.
Halifax, N.S.	96	151	184	265	333	372	410	97.0	1.1	1.9	1698	0.748	57.7
St. John, N.B.	100	162	190	256	295	347	389	97.3	1.0	1.7	1639	0.741	59.5
Quebec, Que.	97	152	179	251	299	361	402	97.3	1.1	1.6	1644	0.740	59.8
Montreal, Que.	101	159	189	269	320	380	416	97.1	1.1	1.8	1733	0.750	57.2
Ottawa, Ont.	100	149	176	255	306	368	408	97.0	1.1	1.9	1662	0.741	59.5
Toronto, Ont.	102	154	183	258	305	366	403	97.0	1.1	1.9	1669	0.736	60.8
London, Ont.	100	157	186	262	308	368	407	96.9	1.1	2.0	1688	0.740	59.7
Winnipeg, Man.	101	159	187	255	297	354	400	97.5	1.1	1.4	1652	0.735	61.0
Regina, Sask.	103	157	183	249	291	350	395	97.2	1.0	1.3	1625	0.731	62.0
Calgary, Alta.	103	155	180	247	293	359	407	97.5	1.2	1.3	1641	0.738	60.2
Edmonton, Alta.	107	157	179	243	288	355	407	97.2	1.1	1.7	1629	0.736	60.8
Vancouver, B.C.	104	163	192	255	298	360	409	97.7	1.1	1.2	1677	0.752	56.7
Victoria, B.C.	103	162	190	249	293	354	402	97.7	1.1	1.2	1650	0.750	57.2
Average:*	101	155	182	254	301	362	406	97.2	1.1	1.7	1660	0.741	59.5

* This is the average for all the samples tested.

TABLE III - AVERAGE RESULTS FOR COMPARISON.

Canada, 1916	125	170	192	237	270	330	380	----			1579	0.732	61.8
Canada, 1923	120	170	193	255	296	358	423	97.1			1695	0.737	60.5
Canada, 1924	113	173	195	249	288	347	410	97.4			1662	0.736	60.8
Canada, 1925	116	174	199	258	299	359	412	97.0			1701	0.739	60.0
Canada, 1926	110	164	191	256	300	360	410	97.4			1681	0.739	60.0
Canada, 1927	107	161	189	259	304	366	416	97.0			1693	0.741	59.5
Canada, 1928	107	160	186	255	298	359	409	97.3			1667	0.737	60.5
Canada, 1929	102	153	181	255	300	363	411	97.0			1663	0.736	60.8
Canada, 1930	101	155	182	254	301	362	406	97.2			1660	0.741	59.5
United States, July 1929	102	---	187	263	---	378	410	96.1			----	0.748	57.7
U.S.Federal Specification Revised 6/11/29	---	122 to 176	---	284	---	392	437	95.0			----	-----	----

Comparison of Results

It is quite interesting to compare the above figures with others obtained in somewhat the same way. Table III gives the average results of 88 samples collected in Canada presumably in 1916, and reported by the laboratories of the Department of Inland Revenue[7]; the average results of the following number of samples collected in Canada in the year indicated; 48 in 1923[8]; 59 in 1924[9]; 73 in 1925[10]; 76 in 1926[11]; 83 in 1927[12]; 77 in 1928[13]; 84 in 1929[14]; and 124 in 1930; the average results of 162 samples collected in the United States during July, 1929, and reported by the U. S. Bureau of Mines[15], and the essential features of the specification (revised June 11th, 1929) for motor gasoline adopted by the Specification Board of the United States[16] for the use of the various department 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 during the present year shows an average of good quality with practically the same volatility as that sold during 1929. According to the data in Table III and the distillation curves in Figure I, the gasoline marketed in Canada during August, 1930, was superior to that sold in the United States during July, 1929, and to the United States Federal Specifications for the United States Government motor gasoline.

Since 1925, there has been a gradual change in the characteristics of the average gasoline marketed in Canada, as indicated in Figure II[17]. This change is particularly noticeable at the lower end of the distillation range as the average temperature of the first drop, 10 per cent and 20 per cent points has been lowered. The average temperature of the 50 per cent, 70 per cent and 90 per cent points has remained fairly constant. The average temperature of the end point has been lowered.

The lowering of the average first drop, 10 and 20 per cent points is probably due to the increased production of gasoline from natural gas and the

TABLE IV - TEN PER CENT OF SAMPLES HAVING MAXIMUM INDEX* NUMBERS.

Sample No.	Brand	Index No. °F.	Spec. grav.	Deg. API	1st drop °F.	DISTILLATION RANGE 10% °F.	20% °F.	50% °F.	70% °F.	90% °F.	End point °F.	Recovery	Residue	Distillation loss
24.	Shell	1821	0.750	57.2	108	162	195	293	347	397	427	96.5	1.0	2.5
38.	Shell	1814	0.752	56.7	106	164	196	290	344	394	426	97.0	1.3	1.7
63.	Erie Oil Co.	1803	0.750	57.2	105	175	212	292	331	377	416	97.0	1.0	2.0
59.	Blue Sunoco	1798	0.765	53.5	104	168	200	284	332	390	424	97.0	1.2	1.8
45.	Cyclo	1790	0.784	49.0	110	164	193	284	340	391	418	97.0	1.0	2.0
52.	Perfection	1781	0.747	57.9	104	158	194	283	334	392	420	97.0	1.2	1.8
21.	Blue Sunoco	1780	0.761	54.4	102	160	196	281	331	389	423	97.5	1.0	1.5
1.	Sunoco	1779	0.762	54.2	97	156	197	281	333	389	423	97.0	1.2	1.8
22.	Cyclo	1779	0.772	51.8	106	161	199	282	337	390	420	97.0	1.1	1.9
32.	Blue Sunoco	1774	0.765	53.5	99	156	193	281	332	391	421	97.0	1.2	1.8
115.	Richfield	1768	0.759	54.9	103	170	204	276	320	380	418	98.0	1.2	0.8
70.	Super Power	1759	0.745	58.4	106	170	202	277	321	375	414	97.0	1.1	1.9
	Average:	1787	0.759	54.9	104	164	197	284	333	388	421	97.1	1.1	1.8

TABLE V - TEN PER CENT OF SAMPLES HAVING MINIMUM INDEX* NUMBERS

108.	High Life	1330	0.697	71.5	106	130	140	173	209	285	393	97.5	1.3	1.2
53.	Super High Grade	1441	0.721	64.8	104	148	168	218	248	295	364	97.5	1.0	1.5
41.	Koolmotor	1460	0.722	64.5	90	124	146	218	269	329	374	97.0	1.0	2.0
99.	Regal Ethyl	1466	0.723	64.2	110	153	166	208	242	309	368	98.0	1.0	1.0
114.	Noroco	1470	0.717	65.9	97	139	157	205	243	326	400	97.5	1.2	1.3
98.	Regal	1484	0.718	65.6	101	138	156	206	247	333	404	97.5	1.1	1.4
7.	No-Nox	1488	0.730	62.3	98	148	171	228	263	313	365	97.5	1.0	1.5
88.	Regal Ethyl	1492	0.720	65.0	97	142	159	209	250	336	396	97.5	1.1	1.4
33.	Super Quality	1499	0.719	65.3	92	124	146	215	270	346	398	96.5	1.1	2.4
95.	High Life Motor	1506	0.720	65.0	86	139	159	213	259	343	393	97.0	1.1	1.9
87.	Regal	1507	0.717	65.9	96	140	156	207	252	340	412	97.5	1.3	1.2
76.	Maple Leaf	1507	0.717	65.9	105	150	170	222	261	326	378	97.0	1.0	2.0
	Average:	1471	0.718	65.6	99	140	158	210	251	323	389	97.3	1.1	1.6

* The index number is the sum of the following points in the distillation range: 10%, 20%, 50%, 70%, 90% and end point.

increased use of cracking equipment at the refineries. The lowering of the average end point with a corresponding smaller difference between the average 90 per cent point and average end point, is probably due to the use of more efficient fractionating equipment such as bubble towers, etc., at the refineries.

In order to determine the variation in quality of the gasoline being sold, the average of the 12 samples (approximately 10% of the total 124 samples) having the highest index numbers and the average of the 12 samples having the lowest index numbers was obtained as in preceding years. The results are shown in Tables IV and V.

TABLE VI - DIFFERENCE BETWEEN MAXIMUM AND MINIMUM INDEX NUMBERS.

	1923	1924	1925	1926	1927	1928	1929	1930
Maximum 10%	1791	1806	1821	1815	1823	1791	1773	1787
Minimum 10%	1500	1428	1497	1524	1518	1488	1503	1471
	291	378	324	291	305	303	270	316

Table VI shows the difference between the average index numbers of the maximum 10% and minimum 10% of the samples collected in Canada in the eight years, 1923 to 1930. 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 the variation in quality during 1930 was greater than that in the past four years.

It will be further observed that the average index number, namely 1787, of ten per cent of the samples having the highest index numbers of all those examined in 1930, is higher than the average index number of a similar grade of samples examined in 1929. This indicates that the average volatility of that grade of samples was lower than the average volatility of a similar grade examined in 1929.

It will be noted that the average index number, namely 1471, of ten per cent of the samples having the lowest index numbers of all those examined in 1930 is lower than the average index numbers of similar grades of samples examined since 1924. This indicates that the average volatility of that grade of samples was greater in 1930 than the average volatility of similar grades of samples examined in the past five years.

Accordingly, it may be said that the lowest grade of samples examined in 1930 was less volatile than a similar grade examined in 1929, and the highest grade of samples examined in 1930 was more volatile than similar grades examined in the past five years.

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1. Chemist, Fuel Research Laboratories, Ottawa.

2. Investigations of Fuels and Fuel Testing, Mines Branch, 1923 to 1928 inclusive, and Memorandum Series, "Gasoline Survey for 1929" (preprint).

3. The hearty support and coöperation of the Department of Pensions and National Health in taking the samples is gratefully acknowledged.

4. Chemical and Metallurgical Engineering, Vol. 29, No. 22, Page 970. Investigations of Fuels and Fuel Testing, 1923, Page 53.

5. U. S. Bureau of Standards Circular No. 154.

6. Gasoline Survey reports in Investigations of Fuels and Fuel Testing, 1927 and 1928.

7. Department of Inland Revenue, Canada, Bulletin No. 362 ("Gasoline").

8, 9, 10, 11, 12 & 13. Investigations of Fuels and Fuel Testing, Mines Branch, 1923, 1924, 1925, 1926, 1927 and 1928 respectively.

14. Mines Branch, Department of Mines, Canada, Memorandum Series, "Gasoline Survey for 1929" (preprint).

15. U. S. Bureau of Mines, Report of Investigations, Serial No. 2959.

16. U. S. Government Master Specification No. 622a.

17. U. S. Bureau of Mines, Report of Investigations, No. 2995.

Summary

One hundred and twenty-four samples of gasoline were collected in August, 1930 from 13 widely separated Canadian cities, and may, therefore, be accepted as representative of the gasoline sold in Canada at that time.

The analyses and detailed examinations show that the average gasoline sold during 1930 was of good quality with practically the same volatility as that sold during 1929, and that the variation in quality during 1930 was greater than that in the past four years.

As indicated by the distillation range, there has been a gradual change in the characteristics of the average gasoline marketed in Canada since 1925. The average temperature of the first drop, ten per cent, twenty per cent and also the end point has been lowered, while the average temperature of the fifty per cent, seventy per cent and ninety per cent has remained fairly constant.

For comparison of the higher and lower quality gasolines two groups, each comprizing ten per cent of the total number of samples examined, were chosen as in former surveys. The higher quality group of the 1930 samples was more volatile than the corresponding groups in the past five years, while the lower quality group of the 1930 samples was less volatile than the corresponding group in 1929.

According to the distillation range and other data obtained, the gasoline marketed during August, 1930, as represented by the samples collected for this survey, was superior to that sold in the United States during July, 1929, as represented by the analyses of samples reported by the United States Bureau of Mines, which gasoline in turn was superior to the United States Federal Specifications for United States Government motor gasoline.

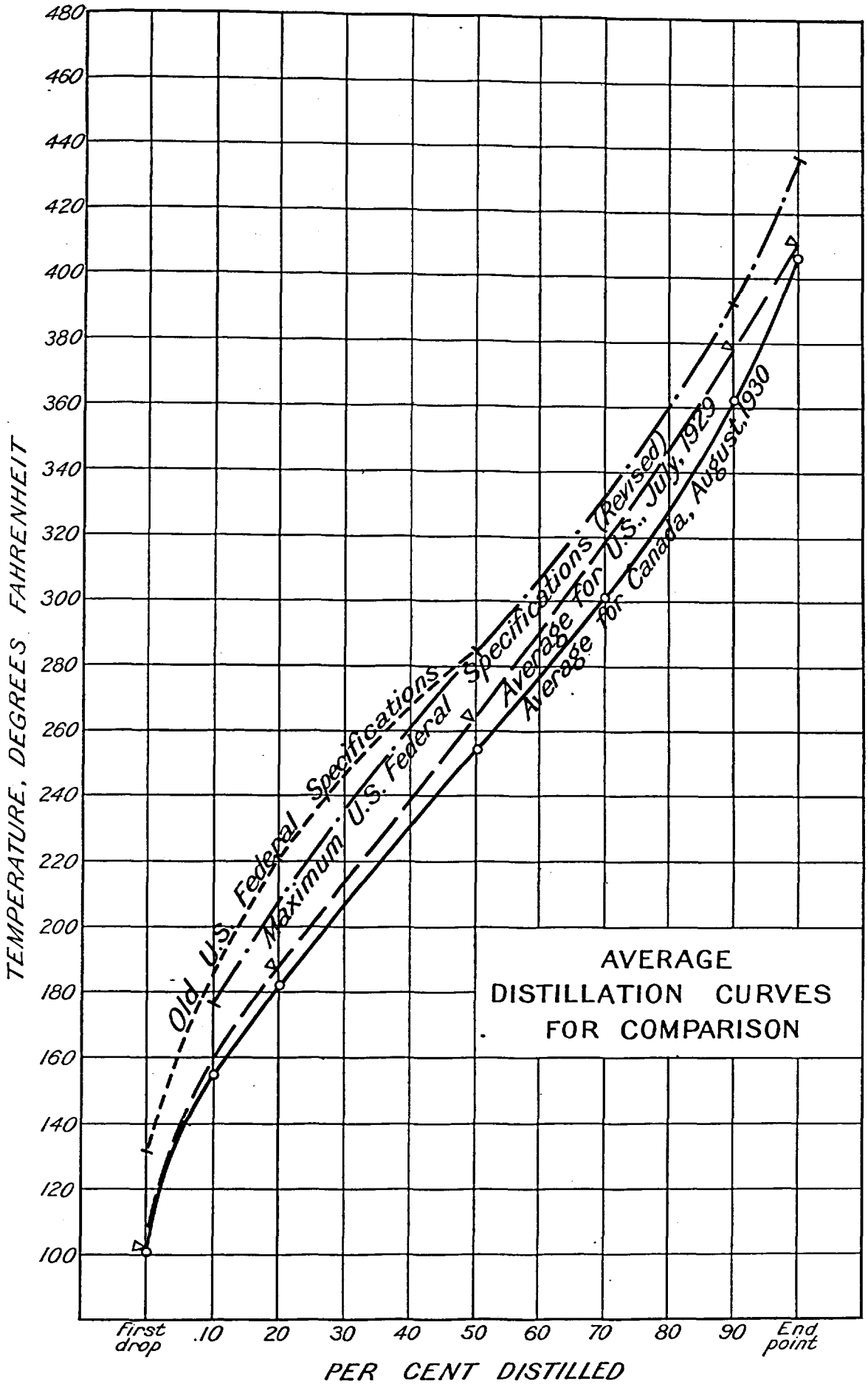
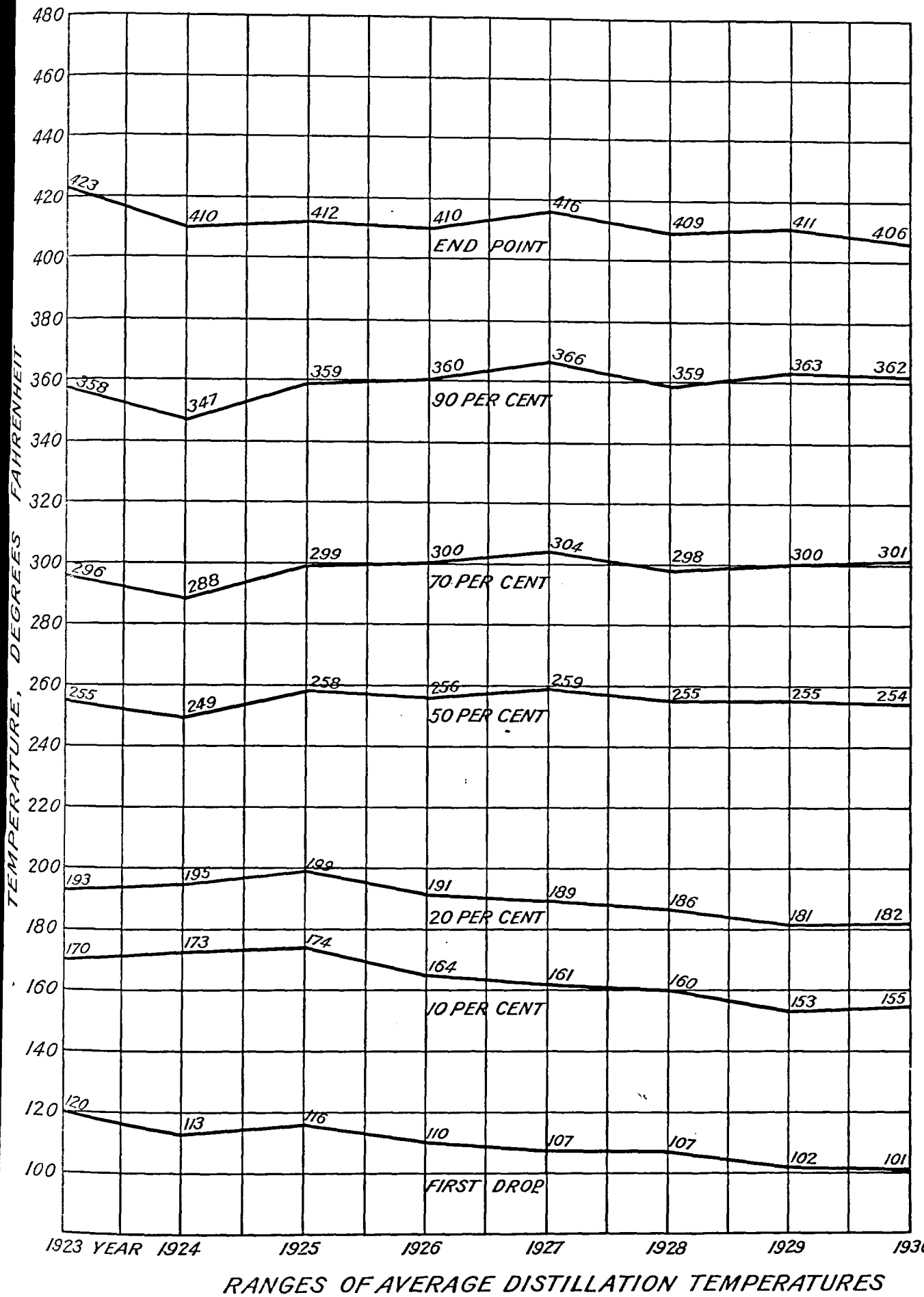

480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
TEMPERATURE, DEGREES FAHRENHEIT
Old U.S. Federal Specifications
Maximum U.S. Federal Specifications (Revised)
Average for U.S., July, 1929
Average for Canada, August, 1930
AVERAGE
DISTILLATION CURVES
FOR COMPARISON
First drop
.10
20
30
40
50
60
70
80
90
End point
PER CENT DISTILLED

Figure 1


TEMPERATURE, DEGREES FAHRENHEIT
480
460
440
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340
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220
200
180
160
140
120
100
423
410
412
410
END POINT
416
409
411
406
358
347
359
360
90 PER CENT
366
359
363
362
296
288
299
300
70 PER CENT
304
298
300
301
255
249
258
256
50 PER CENT
259
255
255
254
193
195
199
191
189
186
181
182
20 PER CENT
170
173
174
164
161
160
153
155
10 PER CENT
120
113
116
110
107
107
102
101
FIRST DROP
1923 YEAR 1924 1925 1926 1927 1928 1929 1930
RANGES OF AVERAGE DISTILLATION TEMPERATURES

Figure 2