



THE EXTRACTION OF GASOLINE FROM
NATURAL GAS.

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PRELIMINARY REMARKS.

The investigation discussed on the following pages was taken up at the suggestion of Dr. H. C. Allen, professor of analytical chemistry at the University of Kansas. The general object was the establishment of a method for the quantitative estimation of the condensable gasoline constituents of so-called "wet" natural gas. Three general lines of experimentation suggested themselves after a preliminary study of the problem. These were the separation of a liquified sample of the gas into its respective individual gases by fractional distillation, the subjection of a sample to various degrees of pressure and cooling such as may be produced in the commercial plant, and the study of the physical and chemical characteristics which might serve as an index to condensable constituents present.

The first method of procedure suggests itself at once as highly scientific and seems to have given good results to certain investigators.¹ The means necessary for the accurate fractionation of a mixture of natural gases are, however, not available in the ordinary laboratory, so this method altho successful and accurate is hardly practical. Even after the fractionation of the gas has

¹Lebeau and Damiens in Chem. Abstr. 7, 1338.

Compt. Rend. 156, 144-7 & 325-7.

Burrell and Seibert in Sampling and Examination of Mine Gases and Natural Gases, 110.

been accomplished and its composition determined it is still impossible to say just what proportion would be condensable into gasoline by means of the machinery of the plant.

The second method mentioned is practical in nature. It has been perfected and used by the Bessemer Gas Engine Company of Grove City, Pennsylvania, for some length of time. As perfected by Frank P. Peterson, chemist for this company, it consists of a portable outfit which can be transported to the oil lease in question and there used to subject the gas to the various degrees of pressure and cooling that might be used in the actual plant. In this way the yield under actual operations is very satisfactorily established.

Although the latter method is perhaps destined to be the final one preparatory to the establishment of plants for the commercial production of gasoline, it is very desirable that there should be available some simple test that could be made use of in any ordinary laboratory on a small sample of gas to give an approximately accurate idea of the efficiency of a gas for gasoline production. The establishment of such a method has been the aim of this investigation.

Natural gas and gasoline are both mixtures of compounds belonging chemically to the same series. The exact composition of both is variable and the lighter constituents of gasoline are often present as the heavier constituents of natural gas. Thus ordinary gasoline is composed principally of the hydrocarbons, (C_5H_{12}) , hexane, (C_6H_{14}) and heptane, (C_7H_{16}) , but may also contain some butane (C_4H_{10}) , while natural gas is ordinarily composed of methane and ethane, but it may also contain considerable quantities of propane. This, for example, is the case with the gas of Follansbee, West Virginia, which contains as high as seventy seven per cent of propane. Besides these three there may be present considerable quantities of the vapors of gasoline, or the heavier gasoline hydrocarbons. This is not infrequently the case since in a large number of instances supplies of natural gas are found physically connected with oil pools and, on the other hand, petroleum beds are in the majority of cases accompanied by more or less extensive supplies of natural gas.

To avoid a possible inference of constancy in composition of natural gas and gasoline from the above statements of their composition it should be said that gases which are found in connection with petroleum vary greatly in physical characteristics, specific gravity and relative

percentage of different hydrocarbons present. This variation is almost as great as that in the great class of liquid petroleum deposits in connection with which they are found.

Natural gas of this type is technically known as "wet" gas while the ordinary gas composed largely of methane and a little ethane is known as "dry" gas. The occurrence of the above named hydrocarbons as either "dry" gas, "wet" gas, or gasoline is indicated from their boiling temperatures.

Methane,	(CH ₄)	-	-	-	-160 C.
Ethane,	(C ₂ H ₆)	-	-	-	-93 C.
Propane,	(C ₃ H ₈)	-	-	-	-46 C.
Butane,	(C ₄ H ₁₀)	-	-	-	0 C.
Pentane,	(C ₅ H ₁₂)	-	-	-	37 C.
Hexane,	(C ₆ H ₁₄)	-	-	-	69 C.
Heptane,	(C ₇ H ₁₆)	-	-	-	98 C.
Octane,	(C ₈ H ₁₈)	-	-	-	

The compounds propane and butane are thus seen to lie on the borderline between the gaseous and liquid state and their physical state will depend to a large extent upon the substances with which they are found associated. As indicated by the brackets in the table the mixture known as "wet" gas contains a variable quantity of the hydro-

carbons of the gasoline type which theoretically should be extractable if properly treated.

The recovery of these extractable vapors has become of such commercial importance during the last few years that it has risen to an industry which compares in no mean way with that of refinery gasoline itself. The total production of crude petroleum for the year nineteen ~~twelve~~ was two hundred million barrels at a value of two and one half cents per gallon of which about ten per cent is gasoline. The production of gasoline from natural gas for the years 1911 and 1912 is shown in the following tables taken from the United States Geological Survey.

Table I.

Production of gasoline from natural gas in the United
States in 1911, by States.

State	No. of Oper- ators	Plants No. Daily capac- ity	Gasoline produced		Value	Gas used		Value	Av. yield gaso- line gals.
			Quantity gals. gallons	Value		Pr. per gal. Cts.	Estimated quantity Cubic feet		
W. Va.	47	72	16,819	3,660,165	\$262,661	7.18	1,252,900,600	\$76,074	2.92
Ohio	26	39	6,454	1,678,985	118,161	7.04	469,672,000	37,574	3.37
Penn.	43	50	5,669	1,467,043	109,649	7.47	526,152,663	52,615	2.79
Okla.	8	8	4,800	388,058	20,975	5.40	144,629,000	4,378	2.68
Calif.									
Colo.	7	7	3,358	231,588	20,258	8.75	82,343,000	6,320	2.81
Ill.									
N. Y.									
Total	131	176	37,100	7,425,839	531,704	7.16	2,475,697,263	176,961	3.00

Table II.

Production of gasoline from natural gas in United
States in 1912, by States.

State	No. op-er-at-ors	Plants		Gasoline produced			Gas used		Av. yield gaso-line Gals.
		No. in op.	Daily capac-ity	Quantity	Value	Pr. per gal.	Estimated quantity	Value	
			Gals.	Gallons		Cts.	Cubic feet		
W. Va.	66	97	22,366	5,318,136	\$513,116	9.6	1,972,802,212	\$163,749	2.8
Penn.	69	83	10,524	2,041,109	217,016	10.6	722,730,117	62,010	2.8
Ohio	25	43	7,791	1,718,719	173,421	10.1	576,123,700	46,090	2.98
Okla.	11	13	11,910	1,575,644	99,626	6.3	701,044,300	24,901	2.25
Calif.	7	7	6,669	1,040,695	112,502	10.8	600,743,000	25,573	1.7
Ill.	4	4							
Colo.	2	2							
N. Y.	1	1	2,008	386,876	41,795	10.8	114,273,000	9,662	3.4
Ky.	1	‡							
Total	186	250	61,268	12,081,179	1,157,476	9.6	4,687,796,329	531,985	2.6

‡Drips.

The tables show that the total number of gasoline plants in operation in the United States increased from 176 in 1911 to 250 in 1912 and that the daily capacity almost doubled.

The natural gas-gasoline industry is shown to have been confined to eight states in both 1911 and 1912. The total production of gasoline from gas in 1912 was 12,081,179 gallons, valued at \$1,157,476 as compared with 7,425,839 gallons, valued at \$531,704 in 1911.

The growth of the industry is shown to be very rapid. Recent surveys by David T. Day¹, of the United States Geological Survey, show that for May, 1913, the production of gasoline by twenty three plants in Oklahoma was 400,000 gallons. At the end of May there were 25,612 oil producing wells in Oklahoma. Of these only 300 were used for the production of casing-head gasoline. It is estimated by the above writer that the value of recoverable gasoline escaping as gas in Oklahoma is 10% of the value of the crude oil produced. This shows that there are still great possibilities in the way of increased production. Recent examination of gases in states other than those mentioned in the table also show the presence of condensable vapors.¹

¹Tech. Paper 57. Utilization of Petroleum and Natural Gas in Wyoming. W.R. Calvert and Geo. A. Burrell.

The two principal processes involved in the recovery of gasoline from natural gas are compression and cooling. These have been comprehensively covered by the patent of John Lathrop Gray in 1906, and the most effective and extensive developments of the industry have been by licenses under this patent.

The essential features in a modern plant are the gas engines, the compressors, piping, cooling coils and storage tanks. These are well represented by the photographs on the following pages.

The engines and compressors, shown in the first picture, represent the first stage in the process. The compression is generally made in "stages". The first stage consists in submitting the gas to a pressure of 25 to 50 pounds per square inch. The compressed gas is then passed thru the cooling pipes, put up in the form of coils, as shown in the second photograph. These coils are made of two inch pipe and they are either placed in a tank of cold water or water is sprayed over them. The quantity of gasoline recovered at this stage is comparatively small.

The residual gas from the first compression is again compressed, this time to a higher pressure which sometimes reaches 350 pounds per square inch. This is known as the









"second stage" compression. The gas is cooled in the coils the same as in the first stage. This stage represents the recovery of the greater part of the gasoline. The amount obtained ranges from one and one-half to four gallons per one thousand cubic feet of gas compressed.

The liquid from the cooling coils is received in the storage tanks represented in the third photograph. It is held here under heavy pressure. For marketing it is withdrawn and usually mixed with the low grade naphthas. This raises the gravity and volatility of the latter so that they can be used in internal combustion engines. The mixing represents the fourth and last stage in the process and is usually done in small tanks like those shown in the fourth photograph. This blending with the heavier naphthas also prevents the loss due to evaporation that occurs when the gasoline is used as produced.

The specific gravity of natural gas gasoline ranges from 0.582 to 0.676. The specific gravity of standard refinery gasoline is 0.738. When the former is exposed to the air or "weathered" it loses from ten to fifty per cent, depending upon the pressure used in its recovery. The blending with heavier naphthas is therefore the most profitable way of using it.

For the successful operation of a plant at least 125,000 cubic feet of gas should be available daily. A few plants are operated on as little as 40,000 cubic feet per day but these are largely of an experimental nature. The installment of a plant should therefore be preceded by a thoro investigation of the gas supply, especially as different well, even when close together, vary greatly in the quantity of gasoline yielded. The gas may be taken from a large number of wells, fifty or more. In some cases these are as far as four miles from the plant.

A single unit plant consisting of two gas compressors, gas engines, piping, cooling coils, storage tanks, housing etc. costs about \$10,000. It will handle about 500,000 cu. ft. of gas per day. Two men, a day and a night engineer, can care for it. The upkeep of course will vary with the conditions but the returns are large.

The figures on the preceding pages represent a product which has heretofore gone to waste and the profits realizable from this source have led to a large amount of experimental work in the way of examination of gases with a view of the establishment of condensation plants. A large part of this work has been done by private concerns interested in the promotion of the industry. Mr. Peterson of the Bessemer Gas

Engine Company has led in this work and has furnished some valuable information. Burrell, Seibert and Allen, and their assistants, of the United States Bureau of Mines, have during the last few years done a great deal of work along this line. Their results appeared a few weeks ago in bulletins published by that bureau. Their work includes a study of the oil yielding gases of the majority of the gas producing districts of the United States.

EXPERIMENTAL WORK.

The following experimental work has been an attempt to remove by absorption the hydrocarbon gases that are condensable into gasoline from a mixture with the lighter hydrocarbons, methane, and ethane, as present in the natural gas of this city. Since a natural gas of the wet type was not available here the samples had to be prepared by mixing before analysis. For this purpose a gas-holder was made by fitting a tubulated bottle of about twenty liters capacity, with tightly fitting rubber stoppers holding strong glass capillary tubing and sealing them in with sealing wax so as to make them perfectly air tight. The bottom opening was then connected by means of rubber tubing to a similar but smaller bottle to be used for leveling. The two glass tubes leading into the large bottle were fitted with thick walled pure gum tubing and this with screw clamps so that the bottle could be tightly closed. In preparing a sample of gas the gas-holder was first filled with water and this displaced by pure carbon dioxide by attaching the generator to the top opening. After filling, the carbon dioxide was in each case tested for purity by absorption in potassium hydroxide. About a quart of light gasoline was then drawn into the gasometer by lowering the leveling bottle.

This remained in a layer on top of the water. After closing the screw clamp at the bottom, the carbon dioxide was exhausted by means of an air pump until the pressure was reduced to between twenty five and thirty five centimeters of mercury. This was enough in some cases to cause the gasoline to boil. The top screw clamp was then closed and the sample left for about a week to allow the carbon dioxide to become thoroughly saturated with the gasoline vapor. After this the pressure was equalised or increased to atmospheric by pouring water into a small bottle and opening the lower screw clamp. A sample could then be taken by attaching a gas burette to the top opening and raising the leveling bottle. This was passed into a Hempel pipette containing potassium hydroxide which absorbed the carbon dioxide and left the gasoline vapor. This procedure gave the volume of gasoline vapor after the gasoline had stood under reduced pressure for several days. This percentage rapidly increased on standing due to the absorption of carbon dioxide by the water that was introduced to bring the pressure inside the bottle back to that of the atmosphere. In some cases as high as fifty per cent of gasoline vapor was obtained after the sample had stood a number of days. By taking the proper quantity of this vapor and natural gas any desired mix of high or low gasoline content could easily be produced.

The estimation of the gasoline content of a gas by absorption is based upon the difference in solubility of the heavy and the light members of the paraffin series in a given solvent. Methane is only slightly soluble in a number of solvents while the solubility of the higher hydrocarbons increases rapidly as the series is ascended. The first object then was the determination of a suitable solvent. For this purpose a large number of solvents were tried, among them absolute alcohol, propyl alcohol, amyl alcohol, or fusil oil, benzene, toluene, chloroform, olive oil, castor oil, cottonseed oil, paraffin oil, rape-seed oil and others.

Owing to the difficulty of preparing the heavier gases in the pure state their solubility was not determined separately. In the case of methane it was found to be about 40 cc. and for ethane about 110 cc. in 100 cc. of alcohol at room temperature. In amyl alcohol the solubility of methane is a little less, about 35 cc. to 100 cc. of solvent, while that of ethane seems to be greater.

Including the heavier gases Watt's Dictionary of Solubility gives the following figures for the solubility in 100 cc. of absolute alcohol at 0 degrees Centigrade.

Gas						Volume Absorbed
Methane	-	-	-	-	-	52 cc.
Ethane	-	-	-	-	-	150 cc.
Propane	-	-	-	-	-	600 cc.
Butane	-	-	-	-	-	1800 cc.

Olson's Chemical Calendar gives for the same gases under the same conditions:

Gas						Volume Absorbed
Methane	-	-	-	-	-	52 cc.
Ethane	-	-	-	-	-	46 cc.
Propane	-	-	-	-	-	790 cc.
Butane	-	-	-	-	-	1800 cc.

Altho such a complete determination for each solvent would have been impractical it is perhaps also unnecessary since the solubility of methane and ethane, and methane alone gives an indication of the usefulness of the solvent. For this reason a number of solvents were first tested with the city natural gas to get an indication of their usefulness. For example, by shaking 50 cc. of the city natural gas with 25 cc. of alcohol over mercury in a Hempel absorption pipette or burette 10 cc. of gas were absorbed. On shaking the same alcohol with a fresh sample of gas 2 or 3 cc. more were absorbed.

The same procedure showed an absorption of 6.5 cc.

from the first sample in 25 cc. cotton-seed oil. With amyl alcohol the first shaking showed an absorption of 8.7 cc. and the second about 2 cc.

Using 25 cc. of solvent and 50 cc. of the city natural gas the following data give in an approximate way the relative efficiency of some of the solvents experimented with.

Solvent	Volume Absorbed
Paraffin Oil - - - -	7.2 cc.
Repe-seed Oil - - - -	6.9 cc.
Linseed Oil - - - -	6.3 cc.
Cotton-seed Oil - - - -	6.5 cc.
Olive Oil - - - -	6.4 cc.
Absolute Alcohol - - - -	10.0 cc.
Propyl Alcohol - - - -	8.0 cc.
Amyl Alcohol - - - -	8.5 cc.
Benzene - - - -	8.8 cc.
Toluol - - - -	10.0 cc.

The absorptions were made at room temperature and are subject to the errors resulting from the changes in temperature and changes in the composition of the gas. The volume absorbed on shaking with the second sample of gas was very near the same in case of the different solvents. Continued absorption was also noticed on shaking with a third and fourth

sample. The results indicate that the solvent becomes saturated with methane on shaking with the first sample of gas owing to the fact that it is almost wholly methane. The continued absorption from successive samples is due to the small quantity of ethane in the gas. This is not sufficient to saturate the solvent when the first sample is shaken.

It is to be noted that there is little difference in the solubility of the gas in the non-volatile fixed oils. The volume absorbed from 50 cc. in 25 cc. of oil being in each case nearly the same and ranging between 6.5 cc. and 7.0 cc. The difference in efficiency is not enough to give one the advantage over the other. The paraffin oil, however, gives more reliable results because it does not form the foamy emulsion with the mercury on vigorous shaking that the other oils do.

A further difference and a point in favor of the paraffin oil is found in the rate of absorption. This is especially noticeable when the absorption is made by bubbling the gas thru the solvent when the number of passages of the gas thru the solvent indicates the rate of absorption.

The absorption apparatus for this process was made by blowing four bulbs in a piece of hard glass tubing

and then bending this between the two middle bulbs so as to form a U tube. Two Lempel burettes with leveling tubes and stop-cocks at the top were attached by means of bent capillary tubing and rubber connections to the ends of the absorption bulbs.

In running an absorption the height of the leveling tube was so adjusted that about 20 cc. of air was left in the right hand burette, the absorption bulbs with the solvent were then connected and the mercury forced up by raising the leveling tube until it reached the middle of the capillary tube when the stop-cock was closed to keep it there. This forced the excess of air to bubble thru the solvent and held the latter all in the left side of the absorption bulbs. This was done in the same way each time that the volume of gas was to be read in order to have the pressure the same and equal to that of the atmosphere. The other burette containing the sample of gas to be analysed was then connected to the bulbs and the gas passed back and forth thru the solvent by raising and lowering the leveling tubes. The contraction was read after each passage back and forth and the absorption continued until the volume remained constant. To facilitate the absorption the bulbs were automatically shaken by means of a water turbine while the gas was passing thru.

The following examples indicate the number of passages of gas back and forth necessary for the complete absorption in different solvents. The figures in the two columns represent different samples of gas having different gasoline content.

Paraffin Oil as Solvent.

Volume of Gas	36.8 cc	37.3 cc
First passage back and forth	31.9 cc	30.6 cc
Second "	30.5 cc	28.7 cc
Third "	29.4 cc	28.2 cc
Fourth "	29.2 cc	28.0 cc
Fifth "	29.2 cc	28.0 cc
Volume of Gasoline vapor absorbed	20.6 %	24.5%

Olive Oil as Solvent.

Volume of Gas	44.4 cc	35.8 cc
First passage of gas	36.7 cc	30.2 cc
Second "	34.0 cc	27.9 cc
Third "	32.0 cc	26.6 cc
Fourth "	31.4 cc	26.0 cc
Fifth "	30.8 cc	25.6 cc
Sixth "	30.6 cc	25.3 cc
Seventh "	30.5 cc	25.2 cc
Eighth "	30.3 cc	25.0 cc
Ninth "	30.3 cc	25.0 cc
Volume of Gasoline Vapor Absorbed	31.7%	30.1%

Castor Oil as Solvent.

Volume of Gas	36.3 cc	36.0 cc
First passage	29.7 cc	30.4 cc
Second "	27.2 cc	28.2 cc
Third "	26.2 cc	26.8 cc
Fourth "	25.8 cc	25.8 cc
Fifth "	25.5 cc	25.4 cc

Sixth passage	25.0 cc	25.0 cc
Seventh "	24.9 cc	24.8 cc
Eighth "		24.7 cc
Volume Absorbed	31.4%	31.3%

A Mixture of Equal Volumes of Absolute
Alcohol and Castor Oil.

Volume of Gas	35.9 cc	37.0 cc
First passage	28.0 cc	28.9 cc
Second "	26.4 cc	25.7 cc
Third "	26.0 cc	25.7 cc
Fourth "	25.8 cc	25.5 cc
Fifth "	25.8 cc	25.4 cc
Volume Absorbed	28.0%	31.3%

Propyl Alcohol as Solvent.

Volume of Gas	36.4 cc	36.8 cc
First passage	25.4 cc	26.2 cc
Second "	23.4 cc	23.7 cc
Third "	22.8 cc	22.8 cc
Fourth "	22.6 cc	22.6 cc
Fifth "	22.6 cc	22.4 cc
Volume Absorbed	37.6%	39.1%

Kerosene as Solvent.

Volume of Gas	47.1 cc	58.4 cc
First passage	43.8 cc	56.2 cc
Second "	43.0 cc	55.8 cc
Third "	42.8 cc	55.4 cc
Fourth "	42.6 cc	55.2 cc
Volume Absorbed	9.5%	5.4%

Of the non-volatile oils paraffin oil was found to be the most efficient, the absorption being complete after the

third and fourth passage of the gas. The volatile solvents as already indicated by the data from the use of the absorption pipette, show a greater absorbing power. Ordinary alcohol is quite efficient, but its use is not desirable because of its high vapor pressure. This is not so great in the case of fusil oil. This is a mixture of the amyl alcohols and has a boiling point of 130 degrees centigrade. This oil has on the whole perhaps given the best results. In the case of a few of the samples of the gas prepared the recovery of the gasoline vapors approximated 100 per cent. Most of the solvents used did not run as high. The nature of the sample had a great deal to do with the amount that could be recovered and the per cent recovered by the same solvent different with the sample.

A large number of tests were made on samples of gas containing gasoline vapor prepared as described on a previous page. The solvents for these tests were first saturated with the city natural gas by bubbling it thru the solvent for a considerable length of time. Its ability to take up more of this gas was then tested by running an absorption with it in the regular way using city gas. When the solvent showed no absorption in this way it was used on the prepared sample.

In this way a mixture of equal volumes of alcohol and castor oil showed an ability to recover from 50 to 60 percent of the gasoline vapors present. Paraffin oil showed a slightly greater efficiency. Kerosene, propyl alcohol and a number of other solvents recovered from 55 to 70 per cent. Fusil oil in a number of cases recovered in the vicinity of 90 per cent.

The following tables indicate some of the results obtained.

Equal Volumes of Alcohol and Castor Oil.

Sample No. 25.

Volume of Natural Gas	-	-	68.0 cc
Vol. " Gasoline Vapor	-	-	5.2 cc
Total Volume	-	-	73.2 cc
Volume Absorbed	-	-	2.6 cc
Volume Recovered	-	-	50.0%

Sample No. 26.

Total Volume of Gas	-	-	58.0 cc
Volume of Gasoline Vapor	-	-	5.4 cc
Volume Absorbed	-	-	2.7 cc
Volume Recovered	-	-	50.0%

Sample No. 27.

Total Volume of Gas	-	-	57.7 cc
Volume of Gasoline Vapor	-	-	6.4 cc
Volume Absorbed	-	-	3.2 cc
Volume Recovered	-	-	50.0%

Sample No. 35.

Volume of Natural Gas	-	-	-	41.2 cc
Volume of Gasoline Vapor	-	-	-	5.0 cc
Volume Absorbed	-	-	-	3.2 cc
Volume Recovered	-	-	-	64%

Kerosene as Solvent.

Sample No. 37.

Volume of Natural Gas	-	-	-	40/1 cc
Volume of Gasoline Vapor	-	-	-	7.0 cc
Volume Absorbed	-	-	-	4.5 cc
Volume Recovered	-	-	-	63%

Sample No. 38.

Volume of Natural Gas	-	-	-	52.2 cc
Vol. " Gasoline Vapor	-	-	-	6.2 cc
Vol. Absorbed	-	-	-	4.0 cc
Volume Recovered	--	-	-	64%

Propyl Alcohol as Solvent.

Sample No. 100.

Vol. Natural Gas	-	-	-	41.5 cc
Vol. Gasoline Vapor	p	-	-	5.2 cc
Vol. Absorbed	-	-	-	3.3 cc
Volume Recovered	-	-	-	63.4%

Amyl Alcohol as Solvent.

Sample No. 63.

Vol. Natural Gas	-	-	-	43.6 cc
Vol. Gasoline Vapor	-	-	-	2.6 cc
Vol. Absorbed	-	-	-	2.4 cc
Volume Recovered	-	-	-	92.2%

Sample No. 64.

Vol. Natural Gas	-	-	-	-	53.9 cc
Vol. Gasoline Vapor	-	-	-	-	4.0 cc
Vol. Absorbed	-	-	-	-	3.7 cc
Volume Recovered	-	-	-	-	92.5%

Sample No. 135.

Vol. Natural Gas	-	-	-	-	54.0 cc
Vol. Gasoline Vapor	-	-	-	-	2.0 cc
Vol. Absorbed	-	-	-	-	1.8 cc
Volume Recovered	-	-	-	-	90.0%

Paraffin Oil as Solvent.

Sample No. 40.

Vol. Natural Gas	-	-	-	-	58.3 cc
Vol. Gasoline Vapor	-	-	-	-	6.2 cc
Vol. Absorbed	-	-	-	-	4.0 cc
Volume Recovered	-	-	-	-	65.0%

Sample No. 162.

Vol. Natural Gas	-	-	-	-	47.0 cc
Vol. Gasoline Vapor	-	-	-	-	4.3 cc
Vol. Absorbed	-	-	-	-	2.9 cc
Volume Recovered	-	-	-	-	69.0%

The variation in the amount recovered by the same solvent merely shows that the absorption is not quantitative as might have been expected. The per cent recovered from the same sample of course was constant but in some way the presence of some of the gases influences

the solubility of others even when given ample opportunity for absorption by long shaking. Practically, however, an absorption of even as much as 75 per cent of the heavier gases present furnishes valuable information as to the value of the gas for gasoline production. These tests can conveniently be made in any place since the only apparatus necessary is the absorption pipette, bulbs and burettes, and the sample of gas required is small. The information gained thereby will be conclusive to show whether the more elaborate tests with condenser, cooler etc. before mentioned should be used to establish the yield.

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