10

REPORT

ON THE

Gases, Vapors, Odors, &c.,

COMPLAINED OF, AND SAID TO BE GENERATED AT

Kerosene Factories, or Cannel Coal Oil Refineries,

IN THE CITY OF BROOKLYN,

THEIR EFFECT ON PUBLIC HEALTH, ETC.

BY JOSEPH B. JONES, M. D.,

HEALTH OFFICER.

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IN BOARD OF HEALTH,
Brooklyn, June 22, 1861.

Resolved, That the Health Officer's Report on Kerosene Factories be printed in pamphlet form.

The resolution was adopted.

WM. G. BISHOP,
Clerk.

Members of the Board of Health.

MARTIN KALBFLEISCH, *Mayor*, PRESIDENT.
CHARLES FRANKS, *President pro tem. of the Common Council.*
JAMES LYNCH, *Alderman.*
DENIS O'KEEFFE, *Alderman.*
CHARLES H. KIMBALL, *Alderman.*

Report of the Health Officer.

HEALTH DEPARTMENT,
June 7, 1861.

To the Hon. the Board of Health:

GENTLEMEN—

The subject referred to me by your Honorable Board, in relation to a nuisance complained of and said to be caused by the "manufacture of an article known as Kerosene," in the production of which, it was stated in the complaint, that certain gases and vapors were generated which were highly prejudicial to health and extremely offensive to the sense of smell; all of which was said to be caused by boiling oils.

This subject I have very carefully examined, and respectfully present you with the following facts and my opinion thereon. The examination has been a work of much difficulty, particularly that part which relates to the gases. This will be readily appreciated, inasmuch as each refiner or distiller professes to operate under different patents to refine these so called oils, employing different kinds of apparatus or machinery, and using different materials as precipitants, purifiers, &c. Some refiners claiming, that by the process employed

by them, it is impossible to generate a gas. Others have pipes attached to their machinery for the discharge of gases generated, and actually claim that they burn the escaping gas as fuel, for heating their stills, and economise thereby in the use of coal. In order to ascertain the nature and constitution of these products, I had to pursue a course of investigation requiring much care, labor, and patience. The importance of giving an unbiased and correct opinion in a matter of such vast financial and hygienic interests, involving a capital of over two millions of dollars invested in this business in this city. I have duly considered, and in order that justice might be done all parties interested, I have availed myself of every means calculated to enlighten me on the subject, and hereby acknowledge, with much pleasure, my indebtedness to Proffs. ANTISELL, ED. R. SQUIBB, M. D., and GESNER, FREDERICK PRICE, H. O. JONES and J. C. BURDICK, Chemists and Refiners.

It is generally admitted at the present time by chemists and geologists, that coal is a "compressed and chemically altered vegetable substance, associated with earthy and a trace of animal matter. Research has fully established the vegetable origin of coal. The leaves of ferns and other succulent plants, more or less resembling those of the tropics, are found in a compressed state between the layers of shale or slaty clay, preserved in the most beautiful manner, but entirely converted into bituminous coal. These can be seen with the naked, unassisted eye; other peculiarities of vegetable origin and structure are demonstrated by the aid of the microscope.

The various changes, by which vegetable matter or wood, through decomposition, is converted into coal, are not fully understood.

When vegetable matters have been submerged under water and submitted to great pressure, they form coals of a homogeneous and laminated appearance; frequently fish remains are found imbedded in them, which serves to account for the animal matter therein contained.

It is well known that carbonic acid gas escapes from faults and fissures, termed "blowers," in the beds of coal or lignite, and this loss of carbonic acid, from woody material, appears to accompany the conversion of wood into lignite.

This is explained in the following manner:

From the formula of wood	$C_{36.}$	$H_{22.}$	$O_{22.}$	take 3 equiva-
lents of carbonic acid,	$C_{3.}$		$O_{6.}$	and one equiv-
alent of hydrogen,		H		the formula of
brown coal	$C_{33.}$	$H_{21.}$	$O_{16.}$	will be left.

By the loss of six equivalents of oxygen, the relation between it and the hydrogen is changed, and the further alteration or change by the loss of more carbonic acid it is converted into mineral coal. Some watery vapor and a quantity of hydrogen comes away united with carbon, as carbureted hydrogen, constituting the fire damp of mines.

If we take the sum of the substances escaping, 3 equivalents of carbureted hydrogen

	C_3.	H_6	
3 equiv. of water		H_3.	O_3.
9 do carbonic acid	C_9.		O_{18}.
	C_{12}.	H_9.	O_{21}.

and deduct them from the formula of wood,

	C_{36}.	H_{22}.	O_{22}.
	C_{12}.	H_9.	O_{21}.
we have	C_{24}.	H_{13}.	O

and this is the formula of "cannel coal."

Canal coal is known as black or bituminous coal and is very rich in volatile matter, and is now generally used to obtain the photogenic or hydro-carbon oils from.

The brown, or lignite, and the anthracite, or glance, are not now as frequently distilled for their oils as formerly, their yield of oil being comparatively small.

The Boghead Cannel Coal of Scotland, or Tornbane Hill Mineral, the Albert Cannel Coal, of New Brunswick, and the Breckenridge, of Kentucky, are the most valuable. The Albert Coal has the lightest specific gravity, its density being 1.13, the Breckenridge is 1.35, and the Boghead is 1.55, this latter is the lightest specific gravity of any of the known European bituminous coals.

"The practical manufacture of oils and allied substances from coal is in the main due to JAMES YOUNG, by whose process, from one hundred parts of Cannel coal, forty per cent of oil, and ten per cent of paraffin, could be obtained.

"He claimed the production of paraffin and its cogeners. This involved the slower distillation of coals at a lower temperature than had been hitherto effected, and this novelty in practice was followed by the novel result of a copious production of isomeric liquid hydro-carbons, so that really two great results were first demonstrated practically by his process. 1st. That coal was material from which liquids could be manufactured economically, as tar, bitumens, and schists, had hitherto been employed; and 2d. That the liquids so formed were paraffin containing compound."—ANTISELL.

That Mr. JAMES YOUNG possesses merit and deserves mention for his researches and contributions, every one at all familiar with the subject must and will admit; but the claims of REICHENBACK and others are over thirty years prior and cannot be ignored. This has been fully and clearly pointed out by Dr. F. H. STORER, of Boston, in his review of Dr. ANTISELL'S work on Photogenic Oils, &c.

Cannel oil is produced by the destructive distillation of coal, and Kerosene fluid is a product of Cannel oil. The term Kerosene is simply a trade mark, both it and Cannel oil are true hydro-carbon fluids. Prof. GESNER, in speaking of the composition of distilled oils, says that "oxygen enters into the composition of all animal and vegetable oils, unless those oils have been submitted to distillation, which, in general removes their oxygen and changes their characters.

"The oils distilled from plants with water are known as essences, or essential oils. They seldom contain oxygen and are therefore called hydro-carbon oils.

"The volatile vegatable oils contain oxygen perhaps without an exception. The oils, distilled from bituminous and oleaginous substances, contain no oxygen when pure; they are composed of carbon and hydrogen and are therefore hydro-carbon oils.

"The greater the quantity of carbon, in proportion to the hydrogen any one of them contains, the greater is its specific gravity, the higher its boiling point, density of vapor, and tendency to smoke, when employed for the purpose of illumination. An excess of carbon, however, does no harm to any oil designed for lubrication, but rather gives it consistency and durability.

"Regarding lamp oils, the greater the amount of carbon they contain, the greater will be their illuminating powers. Oils resulting from the distillation of different oleaginous and bituminous compounds, are not each a single oil of their kind, but consist of many members, which form a series of oils distinct, one from the other. They have the same root, but differ in their branches. Each member of all their several groups contains a different number of equivalents of carbon and hydrogen, forming chains which rise, step by step, from the solid to the liquid, and from dense liquid to a light and extremely volatile spirit, and finally to a gas. Each of those members is capable of forming an entirely new series of compounds, when combined with other elements. The likeness between these oils can only be discovered by their specific gravity, boiling points, and ultimate analysis.

"Carbon and hydrogen combine in a great number of proportions, and consequently produce a great number

of compounds; and as both elements are combustible, their compounds are also combustible and inflammable. At the ordinary temperature, some of these are solid, as paraffin, napthaline, etc.; others are liquid, as the oil of lemons, naptha, etc. Two of them are gaseous, namely, light carbureted hydrogen gas, and olefiant gas, which are the roots of two, if not more, series of compounds. All these compounds are the products of vegetables, or they are produced from the decay or destructive distillation of organic matter."

By the term oil, I understand a thick, viscid mass, generally lighter than water, adhering to the fingers and requiring the use of alkalies for their perfect removal. Found in all animal and vegatable matter, this term "oil," in the complaint, appears to be used in too wide a sense, for the solid and liquid fats and oils are found to be composed of a variety of acids in combination with a sweet principle termed "Glycerine," which in its turn, may be decomposed into acids similar to those obtained from stearic and oleic acids.

We find fats, drying and non-drying oils, to be composed of stearine, (stearate of glycerine), and oleane (oleate of glycerine). These are the simplest principles, and may be separated from each other by the use of steam at 500° F, or by the use of alkalies.

The whole of them are oxidised acids.

The principle from the heating of manna to 400°, termed mannitine, may be used instead of glycerine for the reproduction of the fats. In fact the compound, with acetic acid and mannitine, upon being gently heated, produces the odor of some of the umbelliferous plants,

and no doubt it will ultimately be found as a proximate principle, replacing glycerine.

They consist of the formulæ C. H. O_4, (C. H.—2) O_4, and (C. H.—2) O_8. Many of them are produced from the reduction of the higher forms to lower, but still retaining their saturating power for bases.

By various modes they may be converted into the respective hydro-carbons, which may be converted into their homologous alcohols.

In fact, from this principle, they are classified as the alcohol series of fatty acids.

The following tables will enable you to comprehend the nature and composition of the oils and hydro-carbon fluids :—

NAMES AND COMPOSITION OF THE STEARIC SERIES OF ACIDS C, H, O_4.

Names.	Form.	Composition.	Melting Point.	Boiling Point.	How Obtained.
Melissic,.....	Solid.	C_{60} H_{60} O_4	185°		From wax.
Cerotic,.....	"	C_{54} H_{54} O_4	174°		Do.
Arachidic,.....	"	C_{40} H_{40} O_4	167°		Butter, oil of ground-nuts
Stearic,.....	"	C_{36} H_{36} O_4	159°		Most solid animal fats.
Palmitic,.....	"	C_{32} H_{32} O_4	143.8°		Palm oil, butter, beeswax, and the so-called margaric acid, spermacetic, olean and human fat.
Myristic,.....	"	C_{28} H_{28} O_4	129°		Nutmeg, butter, cocoanut oil.
Lauric,.....	"	C_{24} H_{24} O_4	110°		Cocoanut oil, bay tree berries.
Pelargonic,.....	Liquid.	C_{18} H_{18} O_4	Solid at 32°	500°	Geranium leaves, oil of rhue.
Caprylic, ...	Solid.	C_{16} H_{16} O_4	59°	457°	Butter, cocoa oil.
Aenanthylic,.....	Liquid.	C_{14} H_{14} O_4		298°	Castor oil by dis-
Caproic,.....	"	C_{12} H_{12} O_4		392°	Butter. [tillation.
Valeric, ...	"	C_{10} H_{10} O_4		347°	Valerian root and oxidation of fusel oil, guilder rose-buds and fish oil.
Butyric,.....	"	C_8 H_8 O_4		314°	Butter, fermentation of lactic acid.
Propionic,.....	Solid.	C_6 H_6 O_4	In crystal.	284°	Fermentation of glycerine.
Acetic, ...	Liquid.	C_4 H_4 O_4	63°	263°	Distillat'n of wood.
Formic,.....	Solid.	C_2 H_2 O_4	21°	221°	Red ants, oxalic acid and oxidation of amylaceous, and other organic bodies.

And by the oxidation of olene acid by nitric acid.

THE OLEIC SERIES, (C, H,—2) O_4.

NAMES.	FORM.	COMPOSITION	MELTING POINT.	BOILING POINT.	FROM WHAT OBTAINED.
Crucic,	Solid.	C_{44} H_{40} O_4	93°		Mustard and rape seed.
Doeglic,	"	C_{38} H_{36} O_4	62°		Doegling whale.
Oleic,		C_{36} H_{34} O_4	57°		Non-drying oils.
Eladic,		C_{36} H_{34} O_4			Action of nitric acid on
Physetolic,	Liquid.	C_{32} H_{30} O_4			Sperm whale. [oleic acid.
Moringic,	"	C_{30} H_{23} O_4	Solid at 32°		Oil of ben.
Angelic,	Semi-solid.	C_{10} H_8 O_4			Angelic root.
Acrylic,	Liquid.	C_6 H_4 O_4			Distillation of glycerine.

ACIDS OF (C, H,—2) O_8.

NAMES.	FORM.	COMPOSITION	MELTING POINT.	BOILING POINT.	FROM WHAT OBTAINED.
Sebacic,	Solid.	C_{20} H_{18} O_8	260°		Oleic acid and most fixed oils. [acid.
Suberic,	"	C_{16} H_{14} O_8	257°		Stearic acid with nitric
Pimelic,	"	C_{14} H_{12} O_8	237°		Oleic and nitric acid.
Adipic,	"	C_{12} H_{10} O_8	266°		Do.
Lepic,	"	C_{10} H_8 O_8	290°		Do.
Succinic,	"	C_8 H_6 O_8	356°		Amber, stearic and palmitic acids, with nitric acid, wormwood leaves, resins of the pine tribe, and by fermentation frm asparagin & malic acid.
Oxalic,	"	C_4 H_2 O_8	Sublimed.		Glycerine and nitric acid.

HYDRO-CARBONS OF THE ACIDS, C, H, O_4.

NAMES.	FORM.	COMPOSITION.	Spec.gr. of vapor	BOILING POINT.	HOW OBTAINED.
Melene,	Solid.	C_{60} H_{60}			
Cerelene,	"	C_{54} H_{54}			
Arachilene,		C_{40} H_{40}			
Stereline,		C_{36} H_{36}			
Cetylene,	Liquid.	C_{32} H_{32}	8.007	527°	From spermaceti and ethal.
Myristelene,		C_{28} H_{28}			
Laurilene,		C_{24} H_{24}			
Etaline,		C_{18} H_{18}	4.48	230°	Fatty acids.
Caprylene,	Lighter than HO	C_{16} H_{16}		257°	Castor oil.
Aenanthlene,		C_{14} H_{14}		122°	
Caproylene,		C_{12} H_{12}	2.875	131°	Distillation of several fatty
Amylene,	Liquid.	C_{10} H_{10}	2.386	102°	Fousel oil. [acids.
Butylene,		C_8 H_8	1.852	Gaseous	Oil of coutchouc and valerian.
Propylene,		C_6 H_6	1.498	"	Glycerine and fousel oil.
Ethaline,		C_4 H_4	.978	"	Alcohol, fatty acids and coal.
Methylene,		C_2 H_2	.490	"	

These Hydro-carbons combine readily with Nordhausen sulphuric acid, perchloride of antimony, sulphuric acid of commerce, by agitation, and from which the respective alcohols may be obtained, and with two equivalents of chlorine, bromine or iodine.

It is found that the hydro-carbons of the fatty acids contain equal equivalents of carbon and hydrogen. Those of the photogenic series, at present used, contain from six to eight equivalents less of hydrogen.

The fatty acids, with potash, produce acid compounds with the alkali. The hydro-carbons may be distilled without change.

The fatty acids produce insoluble compounds with metallic salts. The hydro-carbons have no effect on metallic salts.

The fatty acids are oxidised with nitric acid. The hydro-carbons produce nitriles.

The compounds termed essential oils are peculiar compounds, known as stereoptine, in combination with hydro-carbons of the terebene class, of which I present a list.

The whole subject requires a long and severe investigation, for the properties of many of the hydro-carbons of the formula C. H. have not even been studied.

THE ESSENTIAL OILS WITH THEIR CARBOHYDROGEN.

Names.	Formula.	Vapor.	Liquid.	Boiling Point.	Rotation.	Combined with H. Cl.	Remarks.
Terebinthine,....	C_{20} H_{16}	4.812	0.864	318 to 25°			
Isoterebinthine,..	" "		0.843	350°	Left.	Solid.	
				above			
Meteterebinthine,	" "		0.913	680°			From turpentine, and contains oxidated compounds.
Terebene,.....	" "		0.860	320°	None.	Liquid.	
Terebilene, ...	" "	4.767	0.843	273°	"	"	
Camphilene,.....	" "		8.870	273°	"	Solid.	
Bergamotte,.....	" "		0.869	361°	Right.		and C_{30}, H_{10}, O_{10}.
Borniene, ...		4.60		320°	Left.	Solid.	
Birch Tar,.....	C_{20} H_{16}	5.28	0.847	313°			Consists of several oils.
Camomile,.....	" "			347°			and C_{10}, H_8, O_2.
Carroway,.....	" "	5.17	0.938	343°	Right.	Solid.	and C_{20}, H_{14}, O_2.
Cloves,.....	" "		0.918	289°		Liquid.	and C_{20}, H_{12}, O_4.
						Solid and	
Elemi,.....	" "		0.849	345°	Left.	Liquid.	
Hop, ...	" "				Right.		C_{12}, H_{10}, O_2.
Juniper,.....	" "		0.86	320°	Left.	Liquid.	
						Solid and	
Lemons,.....	" "	4.87	0.851	343°	Right.	Liquid.	C_{12}, H_{10}, O_2.
Orange, ...	" "	4.64	0.83	356°	"	"	
Parsley,.....	" "			320°			Contains an oxide,
Pepper,.....	" "	4.73	0.864	333°		Liquid.	
Savine,.....	" "			320°			
Tolu,.....	" "		0.837	320°			
Thyme,.....	" "	4.76		329°	None.	Liquid.	C_{20}, H_{14}, O_2.
Valerian,.....	" "						Contains borneine and C_{12}, H_{10}, O_2.
Copaibi.....	C_{30} H_{24}		0.878	500°	Left.	Solid.	
Cubebs,.....	" "		0.929	490°	"	"	and C_{30}, H_{24} and 2 HO.
Cedrene,.....	C_{32} H_{26}	7.9	0.984	458°	Right.		C_{32}, H_{28}, O_2.
Menthene,.....	C_{20} H_{18}	4.94	0.851	325°			From oil of peppermint.
Colophene,.....	C_{40} HO_2		0.940	595°	None.		
Attar of Roses,...	C H			592°			

Many of the principles contained in these oils are species of camphor; in fact it is thought that the term terebine would be a better term for the so called essential oils.

This subject is one that might occupy years of study to complete, but what is here presented is sufficient to show that the distinction between the oil and hydrocarbon fluid is perfect, if not, then we might, from the physical properties, term nitrate of urea, a fat, and sulphuric, flouric and other acids, oils, &c.

The manufacturer of coal oils is compelled from the the beginning, on economic principles, to not only know, but to have it in his power to control and apply or use in the most scientific manner the amount of heat necessary for the generation of the vapors from which he produces, by condensation, his oils, or fluids. Too high a temperature will prove ruinous to him by converting his vapors into gases, and too low an one will result in a useless and unprofitable consumption of time and fuel.

This is equally true and applicable to the refiners of the crude coal oils, or the producers of the article known as kerosene, and allied substances. The temperature used at these factories and refineries, whether it is where they are engaged in the manufacture of the crude oil from the coal, or refining this crude oil, is that below a red heat ranging from 170° to 600° or 800° Fahr.

The range of temperatures used at factories for the generation of gas from coal for the purpose of illumination, is between 800° and 1400° Fahr. You will perceive

then that the economic production of oil forbids the use of sufficient heat to produce gas.

The changes which occur in animal or vegetable matter vary in proportion to the range of temperature applied to them.

In circumstances where the material operated upon is in contact with a plentiful supply of heated air, not deprived of its free oxygen by any act of combustion, the whole or much the greater part of the carbon will be burned off as carbonic acid, some carbon may remain mixed with the earthy matters of the organic substance forming the ashy coke.

The hydrogen in the substance will escape as water at first, if much be present, as carbureted hydrogen; and with the nitrogen, if the substance contain any, as ammonia—a carbonate of ammonia. But when the exposure to heat is conducted in a close vessel, as in distillation in retorts, another series of changes occur, at the outset, when the heat is inconsiderable, aqueous vapor, organic acids, ammonia and some combustible fluids soluable in water are given off. As the temperature augments carbonic acid, carbonic oxide, water and a number of oleagenous substances not soluable in water are formed. When the temperature rises up to and exceeds a red heat, the products are in a great part or wholly gaseous.

Destructive distillation may be considered as combustion, with a very limited supply of oxygen, merely so much as is contained in the substance itself.

The result of the dry distillation of substances varies in so far as they contain or are deficient in nitrogen. Most of the products are common to both conditions, but where nitrogen is an element, there are many substances formed peculiar to it.

In the cases of organic substances, not containing nitrogen, as wood, resin, oils and fats, &c., the chief products of distillation are water, acetic acid, naptha, or wood spirit, volatile oil, tar, paraffin, creosote, &c.

When the substances contain nitrogen or sulphur, as coal, &c., there are added to the foregoing, ammonia, aniline, leucol, picoline, lutidine and cyanogen and sulphocyanogen compounds. And in all cases, an ashy carbonaceous mass remains in the retort, or still, known as coke.

Such are the changes produced at temperatures below a red heat; at temperatures above this point, a series of gaseous products only are produced, and if there does appear in the ordinary manufacture of gas a large amount of the above volatile liquids, it is because they are formed when the retort has cooled down below a red heat, when they immediately appear and are distilled over.

It is the temperature at which coal is carbonized in the close vessels which determines the nature of the products, if it be high, gaseous fluids will be produced; if it be low, volatile vapors, liquids, alone will form.

This is so well known to gas manufacturers that they use great care to keep their retorts at a cherry

red heat. The results of dry distillation are always very complex. The number of products very great and difficult of separation.

The difficulty of tracing the decomposition of organic matters by heat arises from variations in the temperature, and the non-removal of substances already formed, which in turn are themselves decomposed, and the products of the two decompositions become mingled together. Thus under careful management the distillation of acetic acid gives acetone and carbonic acid; malic acid gives water, malic acid and carbonic acid; but if the temperatures change, another set of decompositions occur, a new set of products are formed, arising from the disruption of the atoms of the first; thus acetic acid gives marsh gas, and malic acid gives fumaric acid; hence if substances be taken through which, either from their mass or their non-conducting power, the heat cannot be uniformly diffused, a number of different reactions take place in different portions at the same time, according to their respective temperatures; the bodies generated in the interior are altered as they approach the surface, and hence a very high degree of complexity is given to the ultimate results.

The tendency of destructive distillation is to produce compounds possessing more simplicity of composition than the original substance, and capable of sustaining the higher temperatures at which they form, unaltered; so that, under the range of temperature indicated, liquids will be formed when the temperature is least, as at the commencement, and gases when the heat has arisen to the high point set down; as in the lower

ranges where liquids are produced, the effect of an augmented heat within this lower range is to lessen the complexity of the compound, by dropping or reducing its amount of carbon, or of hydrogen. It is at the very lowest temperatures that the liquids, containing the highest number of atoms of carbon and hydrogen will be found; and when the temperature arises to that of the formation of gas, this gas, a carbide of hydrogen, is produced at the expense of the complex liquids formed at first, which give off some carbide of hydrogen, and thus have their proportions simplified.

Therefore it follows that augmented temperatures cause the loss of carbon and hydrogen, and consequently the destruction of the polymeric isomeric hydro-carbons formed at low temperatures; and that the smallest range of temperature above that necessary to evolve or produce photogenic oils, is sufficient of itself to bring their destruction."

I might pursue the subject of distillation, both wet and dry, upon both general and specific principles, but sufficient for my purpose is set forth in the foregoing.

You will readily perceive from these facts, that much of the impurities contained in the substances, from which these crude oils are obtained, are driven off in their manufacture, and that the crude oils are in a manner somewhat purified when they reach the refiner.

These crude oils are required to have a specific gravity of 35° Baumé, at 60° Fahr. by the refiners, and the treatment which they give them only raises them some 5° or 6° B.

It would be impossible for any substance of this specific gravity to hold gases, particularly those prejudicial to health. If carbonic acid were generated during the process it would, in the main, be absorbed by the water present.

I have tested at almost every stage of the process of refining Cannel oil, and at almost every temperature, by tapping machinery and applying the pneumatic trough, and have been unable to detect the presence of light carbureted hydrogen, bi-carbureted hydrogen, or olifiant gas, or carbonic acid. I have tested their wells, where they, at times, have on hand thousands of gallons of this substance, and by all tests known have been unable to detect the presence of gases.

Many of the crude oils sent into market at the present, as ANTISELL remarks, are very impure; but competition in refining makes the refiner obtain those the least so, and as a general thing those establishments I have visited, require and use only those of the specific gravity mentioned.

The same process, nearly, for the purification of the crude oils is used, as that employed for its production.

The oil is treated with a certain per cent. of sulphuric acid which unites with several heavy hydro-carbons and removes them from the lighter, upon which it has but little effect, or action. Subsequently they are treated with caustic soda, which dissolves out the creosote or carbolic acid to a great extent, and neutralizes any acid left in the oils or oily acid compounds.—

Other substances are used by some but the same object is aimed at. It is, after sufficient agitation and settling, conducted by means of pipes into stills which are heated at the bottom, externally; some use, in addition, steam superheated or not, the vapors therein formed are then condensed in a worm attached and situated in a large cistern, surrounded by and constantly supplied with cold water, from which, the fluid escapes at the discharge pipe. A large amount of water comes over with the oil, both of which are received into large reservoirs, which are so arranged that the oils can be collected at pleasure. The lighter oils, so called, coming over at first, say at a temperature of 170° to 200° Fahr. are called No. 1, or, A, from 200° to 350° Fahr. No. 2, or B, &c. These are set aside and mixed with others which are heavier and come over later and at a higher temperature; these form the articles of the desired specific gravity which are sent into market for illuminating purposes; while the still heavier oils are either re-distilled or sent into the market as lubricating oils, or further treated for their paraffin. The latter substance is always produced by distillation below a red heat, it melts at from 108° to 116° Fahr. and its boiling point is 700° F. Many products are now rejected by both the manufacturer of the crude oils, and the refiner of the same which will eventually be applied to useful purposes.*

In reference to that part of the complaint which refers to offensive smell, I beg leave to state that were we all constituted alike there would be but little difficulty experienced in determining what was really offensive to

* The refuse of these factories is valuable, in my opinion, for the oil it contains.

this sense, but it, like all the other senses, is subject to certain modifications and influences and controlled to a very great extent by the peculiar organism and idiosyncracy of each individual, being governed materially by the state or condition, at times, in which each organism exists, and the surroundings in which it may be, or have been placed. Odors that are preferred by some are considered nuisances by others. Musk to many is one of the most delightful perfumes, whilst to others it amounts to, in their opinion, a nuisance, being to them unbearable. There is a lady in this city, a relative of his Honor, ex-Mayor Samuel S. Powell, who cannot endure the smell of the essence of peppermint. This perfume is so repugnant to her sense of smell as to create nausea.

There is a standard whereby to judge this sense like any and all others; what is generally admitted to be unpleasant and offensive amounts to a nuisance.

The odor arising from these factories is far from being generally condemed, and does not therefore constitute a nuisance.

I have detected in the escaping vapors, the presence of benzole and the acetate of methyle ; the former resembles in smell the geranium, the latter ether ; both are present in quantities that are perfectly harmless.

If the statements of persons of respectability, not under oath, are to be relied upon, relief has been afforded to quite a number who have been suffering for periods of different duration from bronchial affections, catarrh of the head and even pulmonary difficulty,

by being either engaged in this business of refining cannel oil, or frequent visitors to these places.

The question, whether the substance sold as kerosene oil is explosive, and if so, under what circumstances? is, in my judgment, one of far greater importance to the community than the questions now on complaint before your honorable body.

This article is now extensively used as an illuminator, under advertised assurances that it is a non-explosive material. The consumers of this substance, relying upon such representations, do not use that amount of caution they would were they burning fluids known to be explosive and dangerous.

Within the last year several very severe and serious accidents have occurred from its use. In this city an estimable lady was burned to death, and her husband severely injured by "the explosion of a kerosene lamp." The nature of this substance, in this particular, should be thoroughly investigated, and if found to be a dangerous article, the sale and use of it, with other explosive illuminating fluids, in domestic use, should be brought under such an ordinance as would effectually secure the consumers of it an immunity from danger.

From what I know of the composition of this substance, I am convinced that any article in the market of a specific gravity of 45° Baumé, at 60° Fahr. and above that, is explosive and extremely dangerous, and its sale should be regulated by the Board of Health.*

* The specific gravity test alone should not be relied upon to determine the explosive property of this article.

These refineries can be so constructed and conducted as to be unobjectionable. The causes of what appears to be the objectionable features, depend upon the faulty construction of the apparatus employed, and the disregard paid in some places to cleanliness about the premises.

The nature of the gases generated or escaping in those factories, where they distil coal, coal tar, candle tar, tallow and petroleum, I have not examined.

From the facts presented, I draw the following conclusions:

1st. That gases are not generated at the *refineries* of crude cannel oils.

2d. That the odors emanating therefrom do not constitute a nuisance.

3d. That the public health is not prejudicially effected by refineries of cannel oil, in active operation, within the limits of the city.

4th. That these hydro-carbons are not oils, coming within the meaning of the city ordinance.

5th. They do not *boil oils* at the establishments complained of.

Respectfully submitted,

JOSEPH B. JONES, M. D.,
Health Officer.