HOW KEROSENE OIL IS MADE.*

The dark offensive crude petroleum is first subjected to fractional distillation. The apparatus employed consists of an iron still, connected with a coil or worm of wrought iron pipe, which is submerged in a tank of water for the purpose of cooling it. When the still has been filled with crude oil, the fire is lighted beneath it, and soon the oil begins to boil. The first products of distillation are gases; at ordinary temperatures, they pass through the soil and escape without being condensed. By cooling the coil with ice or by compressing these gases by an air pump into a strong receiver, very volatile liquors called "rhigolene" and "chymogene" are obtained.

Soon the vapors begin to condense in the worm, and a stream of oil trickles from the far end of the coil into the receiving tank. The first oils obtained have a gravity of about 95° Baumé; as the distillation proceeds, the product becomes heavier, 90° B., 85° B., 80° B., 75° B., 70° B., and so on.

In most establishments it is customary to run the product into one tank till the gravity reaches 65° B. to 59° B.; the product, known as crude naphtha, being subsequently separated by redistillation into (1) gasolene, the lightest; (2) naphtha; (3) benzine. When the stream of oil runs from the coil with a gravity from 65° to 59° B., it is diverted into the kerosene tank and continues to run into this receiver till the gravity reaches about 38° B., or until the color deepens to a yellow. This second fraction is the burning oil or kerosene, and is subsequently purified by sulphuric acid and alkali.

After taking off the burning oil, the stream is directed to the paraffin oil tanks, and continues to run there till nothing remains in the still, save coke. The last products have a gravity of about 25° B.

This oil is chilled to crystallize the paraffin, and is then folded in cloths and exposed to pressure to squeeze out the oil. The solid paraffin is purified by repeatedly melting it in naphtha, chilling, and pressing; the oil separated from it is purified with sulphuric acid and alkali, and used for lubricating purposes.

While this is a general outline of the process of distillation, it should be remarked that refiners differ in the details of the operation.

When very large stills are employed, of a capacity from one thousand to thirty-five hundred barrels, the distillation is not continued till coke is formed; but is interrupted when there remains in the still a thick tarry residuum amounting to from five to ten per cent of the original oil. This residuum is afterwards distilled to coke in smaller stills.

By slow distillation in high stills, the heavier oils are "cracked" into lighter oils, so that the refiner need not produce any heavy oil. In many of the largest establishments only three products are obtained from crude oil: 1. Crude naphtha; 2. burning oil; 3. residuum.

The burning oil is deodorized and bleached for market with sulphuric acid and alkali; the crude naphtha is sold for from 3 to 5 cents per gallon, and poured down the oil wells, nominally to clean them, but practically to be sold to the refiner again in the crude oil at 14 cents per gallon; or it is sold to be redistilled for gasolene, refined naphtha, and benzine. The well owners are many of them dishonest enough to pour the naphtha into the crude oil tank. This adulteration averages fifteen per cent. The residuum is sold to be distilled for paraffin and lubricating oil, or it is cracked in high stills, and the product put into the large stills with the crude oil. In this case no lubricating oil or paraffin are manufactured. This is the practice at Cleveland and Pittsburgh. Some redistil the last ten per cent, the colored portions of the burning oil, with the crude oil.

Some place the crude petroleum in large stills and blow steam through it, and thus take off the crude naphtha, before the oil is run into the fire still.

Some manufacturers, who pride themselves upon the superior quality of their special brands of oil, separate certain portions of the distillate, and send them to market as unusually safe oils.

The "Astral oil" is probably the oil which runs from about 54° to 44° B., in other words, the "heart" of the burning oil. As it does not contain the lighter portions of the ordinary oil, its flashing point is 125° Fah., or 25° above the standard of safety, although its average gravity is 49° B. The "mineral sperm" is a heavy oil, which probably runs between 40° B. and 32° B., averaging 36° B. This is so heavy, and requires so high a temperature to volatilize it, that it does not evolve an inflammable vapor below 262° Fah., nor take fire below 300° Fah. Practically it is as safe as whale oil.

Treatment with Acid.—After the oil has been fractioned, it is subjected to the action of sulphuric acid to remove a little color, but more particularly to sweeten it, that is, to remove the disagreeable odor which it still retains. About two per cent, by measure, of acid is poured into the oil, the mixture is thoroughly agitated, and, on standing, a dark tarry sediment separates; this is removed, and the clear oil is then agitated with water, then with alkali, either caustic soda or ammonia. This neutralizes the last traces of acid, and, after removal by water, leaves the oil "sweet." Some of the more careful refiners then subject it to a somewhat elevated temperature to expel a small percentage of naphtha or benzine which it still contains, while a few subject it to redistillation.

Why most of the kerosene in the market is unsafe.—The crude naphtha sells at from 3 to 5 cents per gallon, while the refined petroleum or kerosene sells for 20 to 25 cents. As great competition exists among the refiners, there is a strong inducement to turn the heavier portions of the naphtha into the kerosene tank, so as to get for it the price of kerosene. They change the direction of the stream from the coil of the still when it reaches 65° to 63° Fah., instead of waiting till it reaches 58°. Thus the inflammable volatile naphtha or benzine is allowed to run into the kerosene, rendering the whole highly dangerous. Dr. D. B. White, President of the Board of Health of New Orleans, found that, experimenting on an oil which flashed at 113° Fah., an addition of

One	per cent	of	naphtha	caused it to flash	at....	103° Fah.
Two	"	"	"	"	....	92° "
Five	"	"	"	"	....	83° "
Ten	"	"	"	"	....	59° "
Twenty	"	"	"	"	....	40° "

After the addition of twenty per cent of naphtha, the oil burned at 50° F.

It is, therefore, the cupidity of the refiner that leads him to run as much benzine as possible into the kerosene, regardless of the frightful consequences which result from the frequent explosions.

On every gallon of naphtha run into the kerosene tank, there is a profit to the refiner of 20 cents, or on every one per cent of naphtha added to the kerosene, a reduction of one fifth cent per gallon in the cost of production, which, with kerosene at 25 cents per gallon, amounts to 1¼ per cent. For every gallon of naphtha sold as kerosene, the refiner can afford to throw away four gallons. Nothing is more desirable than the discovery of some use to which the naphtha can be put, which will make such a demand for it as to raise its value above that of kerosene, that it might be the interest of the refiner to separate as much instead of as little as possible. It must not be supposed that the specific gravity of the oil can be considered a safe index of its quality; on the contrary, the specific gravity gives very little idea of the quality, for while naphtha tends to render the oil lighter, the average gravity of good oil is maintained by the heavier oils present. A poor, dangerous oil may be heavier than a safe oil.

Ordinary kerosene flashes at 86° Fah., but has a gravity of 47° B.

THE CHEAPEST PROCESS FOR MAKING A SAFE OIL.

The cheapest process for making an oil that will not flash, that is, emit an inflammable vapor, below 100° Fah., is the following:

1. Run off the naphtha down to 58° B., instead of 65° to 62°, the usual point.

2. Then expose the oil in shallow tanks to the sun or diffused daylight for one or two days.

The increased expense of this plan of refining would not reach more than three or four cents per gallon. This addition would be cheerfully paid by the consumer, to insure himself and his wife and children from a horrible death.

But, the refiner says, I cannot get the advanced price, because the consumer does not know my oil is safer than the cheaper article. This is true, and our only hope is in strict laws, rigidly enforced, which will make it a crime to sell an unsafe oil.

THE YIELD OF DIFFERENT PRODUCTS.

The yield of the different products from crude petroleum varies greatly in different refineries. The following is a fair average for Pennsylvania oil of about 45° B.:

Gasolene	1½
Refined naphtha	10
Benzine	4
Refined petroleum or kerosene	55
Lubricating oil	17½
Paraffin	2
Loss, gas, and coke	10
	100

By cracking, the same oil could be made to yield

Crude naphtha	20
Burning oil	66
Coke and loss	14
	100

*From a report to the New York Department of Health by Professor C. F. Chandler.

Gymnastic Balloonists.

The New Haven *Palladium* describes the performances of Miss Leona Dare, a Connecticut circus woman, who from being a humble performer under the tent has risen to remarkable experiences as an aeronaut. She has lately been thrilling the people of the West by trapeze performances while suspended from a balloon. One of these recent entertainments at Indianapolis is thus set forth:

The balloon was inflated, and at a quarter to 8 was cut loose; and the fine formed Leona, in circus clothes, dangling down from the trapeze bar, holding in her teeth a strap which encircled the waste of Tommy Hall, a companion for her first voyage in the air, left *terra firma*.

Everything was as still as death, and it was observed that Hall weakened a little, but the plucky "Queen of Antilles," Leona, was perfectly cool. Just as soon as they left the earth, Leona commenced spinning Hall around until it made us giddy. After this performance, and when about three hundred feet in the air, they commenced their highfalutin' performance, known in show language as the double trapeze.

They performed all the difficult and hazardous feats at an altitude of about half a mile, with the same reckless daring that characterizes their performances under the pavilion, where, if they were to tumble, their fall would not exceed thirty feet. Up, up they went, until they were scarcely larger than a person's hand, and, when looked at through a glass provided for the occasion, it was seen that they had climbed upon their trapeze car, and were apparently enjoying a *tête a-tête* while resting from their exciting and perilous exercises. The balloon descended very rapidly and landed about half a mile from the starting point, in an open field, and a party rode up in time to witness their alighting. Hall was silent and sober, while Leona, laughing, said to Warner: "How was that for high?"

The Opal.

The opal comes from Hungary and Mexico. The Hungarian opals are much the superior, and have not the disadvantage of deteriorating with time. For the perfection of an opal, it should exhibit all the colors of the solar spectrum, disposed in small spaces, neither too large nor too small, and with no color predominating. The opal is sometimes called the "harlequin," in allusion to the great variety of colors which it displays. The substance of the opal is of a milky hue and of a pale greenish tint. This milkiness is generally known by the term opalescence. It is the color of water in which a little soap has been dissolved. In order to explain the brilliant colors of the opal, we may imagine in the stone a great number of isolated fissures, of variable width but always very narrow. Each fissure, according to its width, gives a peculiar tint similar to the effect produced by pressing two plates of glass together: we may recognize violet, blue, indigo, red, yellow and green, the last two being exhibited more rarely than the others.

As a proof that the brilliant colors of the opal are due, as we have said, to narrow fissures, similar colors may be produced by partially fracturing, with the blow of a hammer or a wooden mallet, a cube of glass or even a rock crystal. Colors obtained in this way are of the same character as those of flowers, which result from the overlaying of the transparent tissues of which the petals are composed. Herein lies the secret of all their varied hues from their first opening until their final decay.

Sometimes the opal is colored only in its substance, and has not so great a play of light as when it is variously traversed by fissures, and then it is not so much esteemed. The opal is not a very hard stone. In its chemical composition, it is only quartz combined with water. Heat, expanding its fissures, varies its colors, and pressure obviously produces the same effect. M. Babinet states that he thus often changed, without permanent alteration, the colors of a beautiful Hungarian harlequin opal. The opal of the Roman senator Nonius, of the size of a hazel nut, which he selected from among all his treasures as the companion of his exile, was estimated at about 800,000 dollars, This gem has appropriately been called "the Koh i-noor of Rome."

Improvements in Blasting.

T. Klerity, a German engineer, has lately introduced an improved blasting cartridge, which is said to save much powder or dynamite, and seems to be worth notice. The new feature of it consists of a cast steel cylinder, which is inserted in the cartridge, and replaces a part of the powder, which is ignited through a touch hole in the cylinder. At both ends the cylinder is very near the calibre of the bore hole, but its middle part, for about 2-3 of the whole length, is reduced to half that diameter. This thin part has a channel bored through it at right angles to its axis, while another vertical channel follows the axis from the top until it reaches the transverse passage, both of which are filled with fine grained powder and ignited in a suitable way. The length of the steel cylinder is 12 or 14 inches, and its diameter 1 to 1½ inches at the ends, and ½ to ¾ inch in the middle. It is inserted in a cylindrical paper bag, and the powder of dynamite filled between the reduced diameter and the paper; it is then placed in the bottom of the blast, covered with a certain thickness of tamping, and fired in the usual way through the channel in the centre. Another improvement with the use of dynamite has lately been made at Raibl, in Carinthia, where the dolomitic limestone is very cavernous, and much of the power of the explosive is lost, its gases expanding uselessly into these cavities. In order to prevent this, a watertight dynamite cartridge is introduced into the bore hole, and before firing it, as much water pumped into the same as it and the next adjoining cavities would hold. Through this very simple expedient, a wonderful effect is said to have been produced, by which half of the former expenses of blasting were saved.

Coal in China.

According to Baron Richthofen and others, the Chinese coal fields cover an area of upwards of 400,000 square miles; 12,000 miles of coal have sufficed to make Great Britain the greatest workshop of the world. In the province of Hunan, a coal field extends over an area of 21,700 square miles. There are two perfectly distinct coal beds in Hunan, one bearing bituminous and the other anthracite; the latter being most conveniently situated with regard to conveyance by water, easily mined, and covering an area equal to that of the anthracite coal fields of Pennsylvania. In quality this coal will compare favorably with the best kinds of anthracite known.

The coal area of the province of Shansi is of the enormous extent of 30,000 square miles. This is capable of supplying the whole world, at its present rate of consumption, for thousands of years, and has unrivaled facilities for mining. The beds vary from twelve to thirty feet in thickness, while the system of coal bearing strata in this province is about 500 feet in thickness, and contains, besides, an inexhaustible supply of iron ore. Ping-ting-chau is conspicuous for an extraordinary and exceptionally favorable uxtaposition of coal and iron.