THE CENTURY MAGAZINE.

VOL. XXVI. JULY, 1883. NO. 3.

STRIKING OIL.

NEARLY all the petroleum that goes into the world's commerce is produced in a district of country about a hundred and fifty miles long, with a varying breadth of from one to twenty miles, lying mainly in the State of Pennsylvania, but lapping over a little on its northern edge into the State of New York. This region yielded, in 1881, 26,950,813 barrels, and in 1882, 31,398,750 barrels. A little petroleum is obtained in West Virginia, a little at various isolated points in Ohio, and a little in the Canadian province of Ontario. There is also a small field in Germany, a larger one, scantily developed, in Southern Russia, and one still larger, perhaps, in India. The total production of all the fields, outside of the region here described, is but a small fraction in the general account, however, and has scarcely an appreciable influence upon the market. Furthermore, the oil of these minor fields, whether in America or the Old World, is of an inferior quality, and so long as the great Pennsylvania reservoir holds out, can only supply a local demand in the vicinity of the wells.

The petroleum region of Pennsylvania and New York is a hilly or mountainous country, covered largely by forest growth and drained by the Allegheny River or its tributaries. It must not be supposed that the oil-bearing sandstone stratum underlies all this region. It is found only in spots, patches, and belts, and there are no surface indications to show where it can successfully be sought. The entire productive territory covers an area of only 180,000 acres. The outlines of a producing district are established only by experiment, and new districts are discovered by wasting large sums of money on "dry holes." When once a new "pool," or belt of producing territory, is found, the wells multiply rapidly on all sides of the pioneer well until the limits are found. When a dry well demonstrates that the edge has been reached in one direction, no more are bored so far out; and so it is in other directions. After the territory is outlined, it is tolerably safe to bore within it, though there will be important differences in the yield of wells close together, and as the number increases the average yield will diminish.

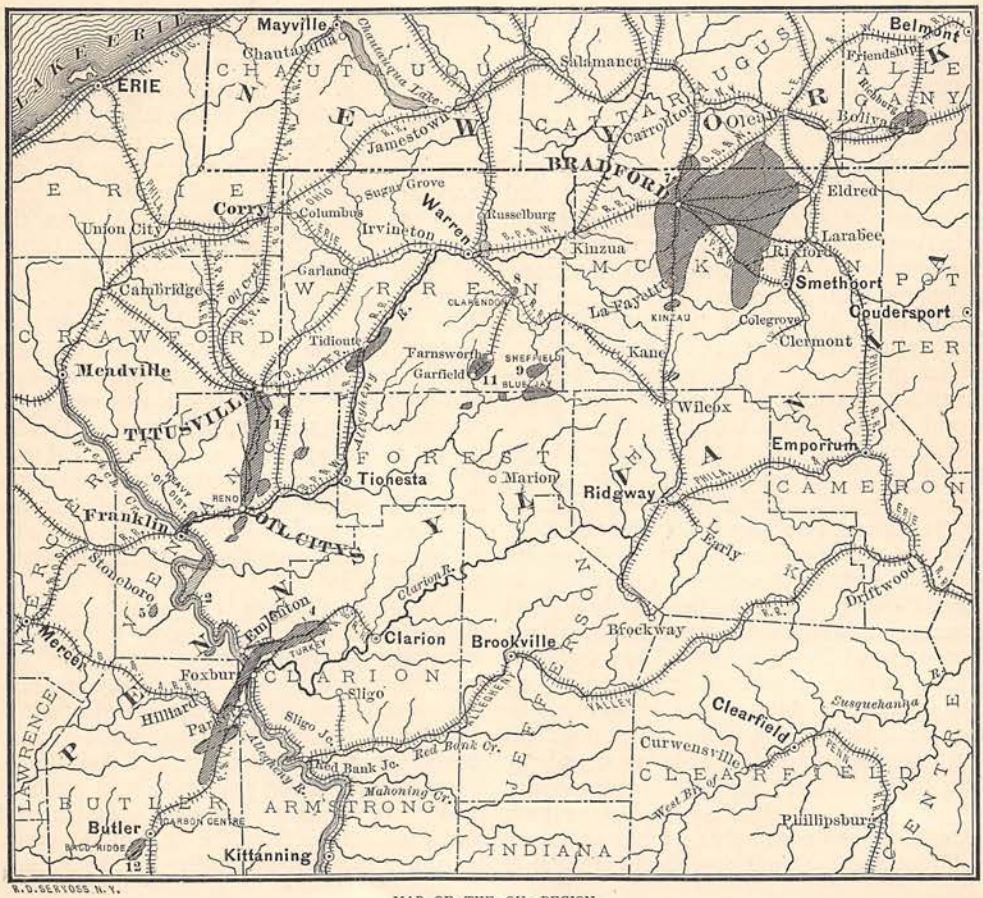
A glance at the accompanying map will show the shape and extent of the different producing fields. The first to be developed was the Oil Creek field, with the outlying pools of Pithole and Pleasantville and the little belt near Tidioute. Next in order came the Butler, Clarion, and Warren fields; then the great Bradford field, the Allegheny field, then the phenomenal and disastrous Cherry Grove field; and, last of all, a little pool lying in the extreme southern end of the region and called Bald Ridge. It will thus be seen that production, beginning in the center of the now known region, has been pushed north-east and south-west, constantly opening new fields of greater or less extent, but never going very far off a diagonal line on the map. Oil men talk a great deal about the forty-five degree line, and believe that any future discoveries of producing territory will be found either on an extension of that line or in the gaps that now exist in it.

The older districts are now nearly exhausted. A little oil is got in them by pumping; but more than nine-tenths of the wells that used to flow abundantly are now abandoned, and only the blackened and rotting derricks mark their location. Towns in these districts which once counted their inhabitants by thousands, and were busy marts of trade and speculation, have absolutely perished and disappeared from the face of the earth, leaving scarce a vestige behind. The outlines

of the old streets can be seen in the fields, but the houses have been pulled down or carried off bodily.

In speaking of the different producing districts, I have not mentioned that surrounding the town of Franklin. Its product is a heavy oil, used in its natural state for lubricating purposes, and worth five or six times as much as other crude petroleum. Only a small quantity is obtained, and the article is as distinct from the general product of the region as though it were lard oil or sperm oil. A few barrels of this thick oil are also obtained from wells at Mecca, in Trumbull County, Ohio, and a few in Illinois.

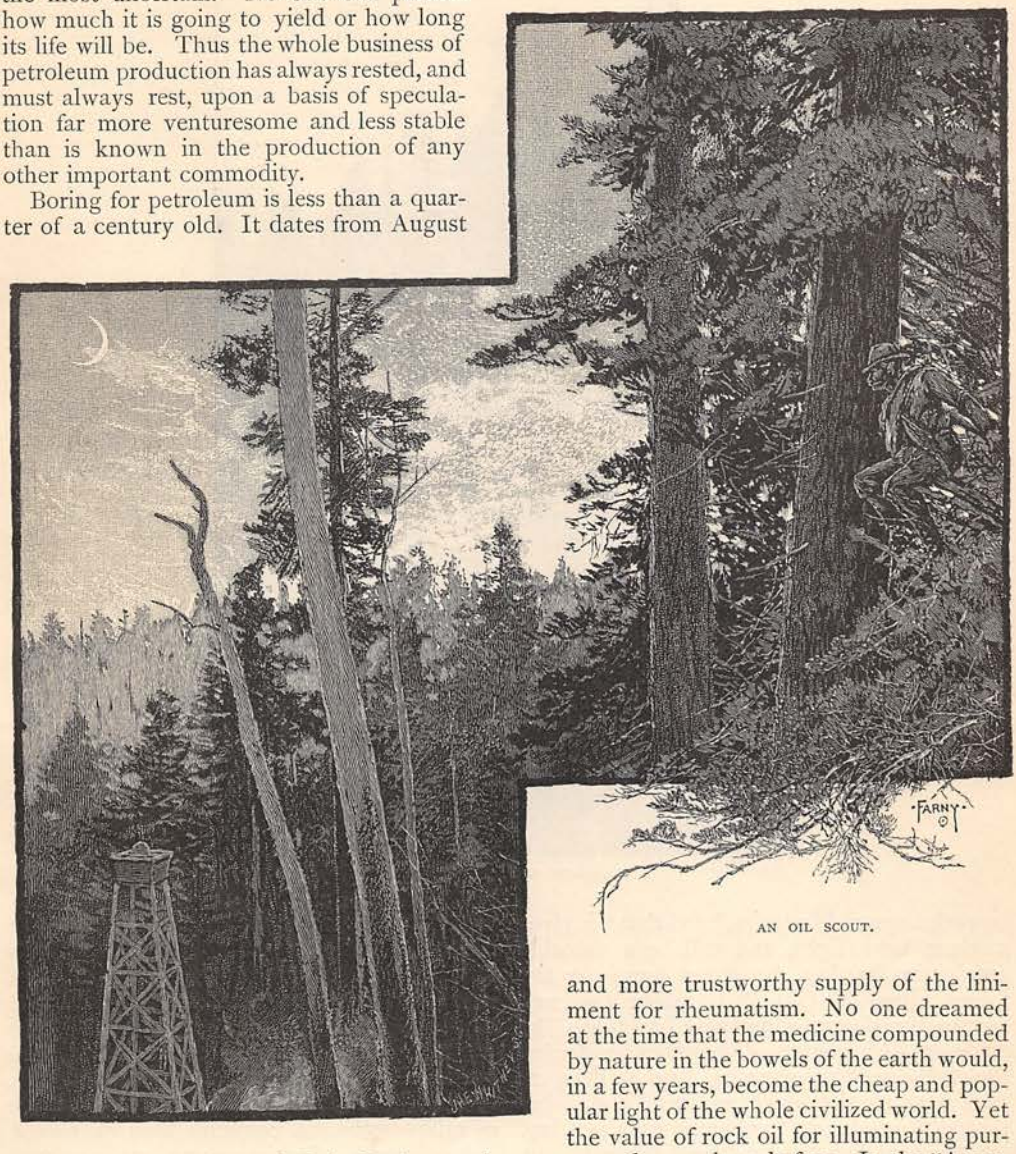
On Oil Creek, the first wells struck the oil-bearing sandstone at a depth of 600 feet. In the Butler and Clarion fields the wells are about 1400 feet deep, in the Bradford field from 1100 to 2000 feet, in the Allegheny field from 900 to 1400 feet, and in Cherry Grove 1600 feet. The variation of depth in the same field is caused by the hills. The oil stratum lies on a level, and a well sunk on a hill-side or a hill-top must go down as much deeper than a well in a valley as its mouth is elevated above the valley. In the early days of the oil business, all wells were sunk in valleys; but, after awhile, it was found that there was just as good producing territory on the slopes and summits of the neighboring hills, and a matter of three or four hundred feet more drilling was not important. The oil sand-stratum varies in thickness from five to thirty feet. It is thickest in the Bradford field. There it is dark colored and fine-grained; elsewhere it is of lighter color and more porous. There are no streams or ponds of petroleum in the earth, as was once supposed. The sandstone is saturated with the oil, and a strong pressure of gas forces the fluid through the porous rock and up to the surface when a hole is drilled down to it. After the gas pressure is relieved, a well is pumped, sometimes for a few weeks only, sometimes for years. Some wells flow intermittently, from periodical accumulations of gas; some continuously until exhausted. Some will yield only a barrel a day; some have been known to spurt three



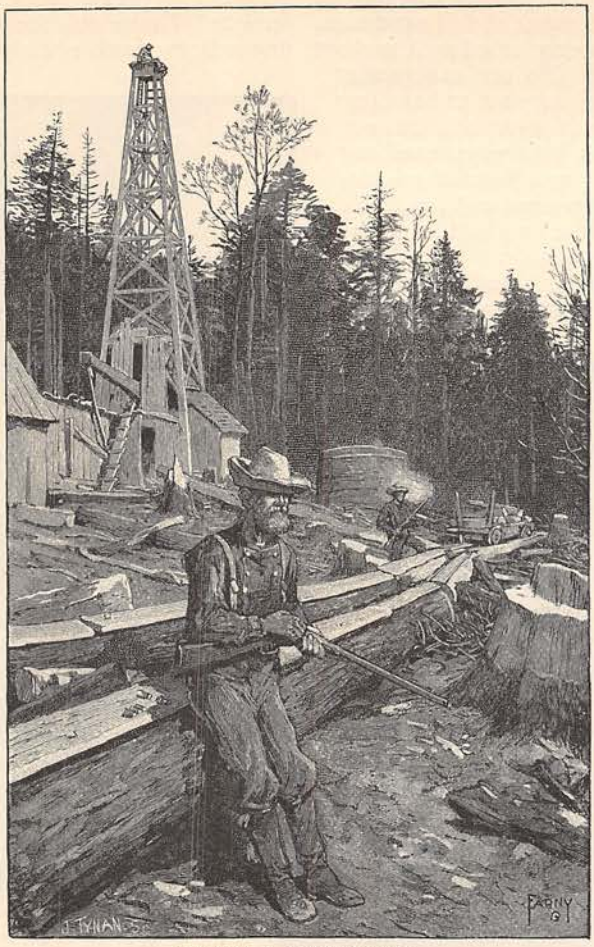
MAP OF THE OIL REGION.

thousand barrels within the first twenty-four hours after the drill struck the oil sandstone. Of all forms of property, an oil well is about the most uncertain. No one can predict how much it is going to yield or how long its life will be. Thus the whole business of petroleum production has always rested, and must always rest, upon a basis of speculation far more venturesome and less stable than is known in the production of any other important commodity.

Boring for petroleum is less than a quarter of a century old. It dates from August 30th, 1859, when Colonel E. L. Drake struck oil on the Drake farm on Oil Creek. He had faith that the greasy, bad-smelling fluid which floated on the surface of the creek and oozed from crevices in the rock could be found in large quantities by sinking wells. This fluid had long been sold by a patent medicine company, under the name of Seneca Oil, as a remedy for rheumatism. Its curative virtues were known to the Indians at an early day, and they used to gather it by stretching their blankets on the surface of the water and then wringing out the oil absorbed in the fabric. It was the patent medicine company that furnished Drake with the money to bore the first well, the motive being to procure a larger and more trustworthy supply of the liniment for rheumatism. No one dreamed at the time that the medicine compounded by nature in the bowels of the earth would, in a few years, become the cheap and popular light of the whole civilized world. Yet the value of rock oil for illuminating purposes was known long before. In the "American Journal of Sciences" for 1826 there is a letter from Dr. S. P. Hildreth, who speaks of the discovery of petroleum on the Muskingum River, near Marietta, Ohio, by a man who sunk a well for salt water. The searcher for brine put down a hole four hundred feet, and, instead of salt water, it "discharged vast quantities of petroleum or, as it is vulgarly called, Seneca Oil." Dr. Hildreth speaks of powerful explosions of gas from the well, and goes on to say that "the petroleum affords considerable profit, and is beginning to be in demand for lamps



AN OIL SCOUT.



GUARDING A WILD-CAT WELL.

in workshops and factories," and that " it gives a clear, brisk light, and will be a valuable article for lighting the street lamps in the future cities of Ohio." Probably the well on the Muskingum soon ceased to flow. The tradition of it remained, however, and after the Oil Creek discoveries, new wells were sunk near its site which produced and, I believe, still produce a few barrels each per day.

The new light soon found favor in the United States. In 1859, Colonel Drake's well produced about 2000 barrels of oil; in 1860, new wells brought the total yield up to 500,000 barrels; in 1861, it was 2,113,609 barrels, and in 1862, 3,056,690. Inventions speedily produced improved lamps to burn the new fluid, and refiners succeeded better and better from year to year in taking out the substances that clogged the wicks and made the lamps smoke. The " coal oil," as it was then generally called, taking the name before applied to kerosene distilled from coal, did not compare in purity and light-giving quality with the refined oil of the present day; but it was cheaper and better than any lamp oil then in use. In fact, it supplied an urgent demand of the whole world for " more light." The whale had almost been exterminated, and sperm oil was so dear as to be out of the reach of the poorer classes. Candles made of tallow were the common light of people living outside of cities where gas was provided. They were costly in proportion to the light they gave, and it was a poor light at best that could be got from them by frequent snuffing. A fluid called " camphene " was made from turpentine, which was a slight improvement on the tallow dip. Later, an oil was made from bituminous coal in considerable quantities. Poor people could not afford sufficient light to read by of evenings. A few flickering candles were all that the economy of the ordinary class of farm-houses allowed. Who can estimate the value of the work

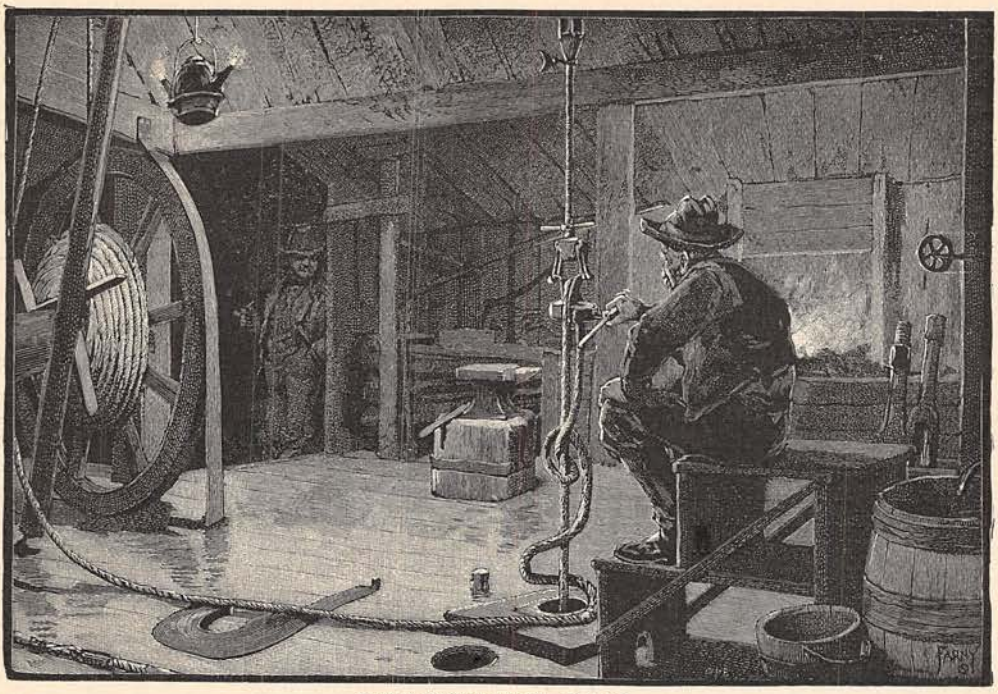
petroleum has done in twenty-three years for intelligence, culture, and the household virtues? It has made the evenings bright and cheerful in millions of homes. The luminous lamp invites to study and reading, to social games and music, to good conversation, to wit and merriment. In a word, it is a powerful force in the advancement of civilization, —a force which the social scientists, who have so much to say about railroads and electricity, rarely take into their account of the world's progress.

The production of crude petroleum fell off in 1863, 1864, and 1865; but the discovery of the new Tidioute district and of the famous flowing wells of Pithole brought it up, in 1866, to 3,887,700 barrels. The Butler and Clarion counties fields, and fresh discoveries in Venango County, ran the production up steadily during the following years, until it reached 10,809,852 barrels in 1874. Then came two years of decline, the older wells giving out and the newer ones yielding less and less. In 1875, the Bradford field was discovered. Its development proceeded so rapidly, and it proved to be of so great extent, that, in 1880, its yield was double that of all other fields in 1874, and about six times as great as all others at that time. Of the 26,000,000 of barrels produced in 1880, over 22,000,000 came from the Bradford district. The Allegheny district was opened in 1881, and now ranks next to Bradford; and the phenomenal Cherry Grove field in Warren County had its rise and fall in 1882. A number of small districts, or pools, in Warren, McKean, and Venango counties were opened between 1875 and 1881.

For sudden and enormous effect upon values, the Cherry Grove excitement of last summer was without parallel in the history of the petroleum trade. It surpassed the famous Pithole furore of 1865. Cherry Grove is a wilderness township of Warren County, which, prior to last May, was almost uninhabited, its population consisting of half a dozen farmers and a few tan-bark cutters. On election night, the politicians at the county seat used to know exactly how the township would vote, and did not need to wait for the returns from that quarter when figuring up the result. For many years the vote stood twelve Republicans and two Democrats. Nearly in the center of the township was a little clearing embracing a few farms; all the rest was a dense, primeval forest of hemlock and birch, where so little light penetrated the canopy of interlaced branches that it always seemed after sundown. About ten miles from the clearing lay the little oil town of Clarendon, on the Philadelphia and Erie Railroad,—a pocket-field, as the oil men call it, developed about ten years ago, and containing about two hundred wells within sight of the railway station. The "wild-catters," as the prospectors are called who take the risks of sinking wells in unknown territory, had long had a theory that oil would be found south-west of Clarendon; but it was only in the spring of 1882 that a party of four of them ventured to put up a derrick in the clearing in Cherry Grove and began to drill. There seemed to be a premonition in the oil exchanges of the tremendous consequences to follow the sinking of 646, as the well was called, from the surveyor's number of the lot upon which it was located. Its progress was observed with feverish interest. The leading oil brokers of Bradford and Oil City employed scouts to watch it after the hole had got down nearly to the depth where it was expected the oil-bearing sandstone would be reached, and to make daily reports of its condition. The owners boarded the derrick up and stood guard at night with shot-guns, firing at random into the woods to keep the spies from getting near enough to learn anything. In spite of these precautions, one young man managed to evade the guard, and, crawling up to the well in the night, concealed himself under the derrick floor, where he lay for seventeen hours, escaping at last with the precious knowledge that 646 was a flowing well—knowledge which, it is said, brought fortunes to him and to the brokers who employed him.

When at last the mystery about the Cherry Grove well was cleared up, and the fact was established beyond dispute that it was spouting out the largest stream of oil that ever came from a single well,—actually yielding four thousand barrels the first day,—the effect was tremendous. It is estimated that in a few days' time the value of oil on hand and of oil territory and wells suffered a shrinkage to the enormous amount of thirty millions of dollars. Crude petroleum, which had been selling at eighty-five cents per barrel, tumbled down and down and down until it got to forty-nine cents—a figure far below the cost of production by any except big-flowing wells. The reader will ask why the opening of a single well, even though it produced the prodigious yield of four thousand barrels a day, should have been followed by such serious results. The answer is, because every one in the oil regions knew that it was not a question of one new well but of a new producing district, and that scores and perhaps hundreds of other wells would soon be flowing within gun-shot of 646.

In a few days the hemlock woods of Cherry Grove township were alive with men and



IN THE DERRICK-HOUSE — DRILLING.

teams, hauling boilers, engines, drilling-tools, lumber for derricks and shanties, kegs of beer, boxes and barrels of provisions, furniture,— all the equipment, in short, of a new settlement. It was May 17th when 646 struck oil. Before the end of June, two bustling towns had sprung up near by,—one called Garfield, in honor of the martyr president, and one Farnsworth, for the owner of the farm where the wonderful well was sunk. Land that had lately been sold at four dollars an acre to pay the taxes changed hands in five-acre tracts at from $500 to $1000 an acre. Hotels, stores, machine-shops, saloons, and a theater sprang up as if by enchantment. The forest aisles, but lately sunk in the silence of centuries, resounded with the shouts of teamsters, the clatter of machinery, the clinking of sledges upon anvils, the sharpening of drills, and the noise of saws and hammers. By the first of October, three hundred and twenty-one producing wells had been sunk in the Cherry Grove territory, each well representing an average expenditure, for engine, derrick, boring-tools and equipment, of three thousand dollars. Thus, over a million of dollars was spent in four months' time upon a little strip of Pennsylvania forest and clearing two miles long by half a mile wide.

The wells that struck oil soon after the great success of 646 all yielded heavily, with the exception of a few that were sunk outside the narrow producing belt, and that served, by their dry holes, to define the limits of the belt. A thousand-barrel well was no wonder in those exciting days, and a man whose well only spouted five hundred the first twenty-four hours after he struck the oleaginous stratum thought he had but moderate luck. But as new wells were put down the flow of the older ones steadily decreased, under a law that governs all newly opened petroleum districts. There is only a given quantity of oil in the ground under pressure of gas, and the more the subterranean reservoir is pierced, the less powerful is the gas pressure, and the flow from each aperture is necessarily diminished. In August, the Cherry Grove field produced forty thousand barrels a day; but from that maximum it steadily declined, and when I visited it in October, the total daily yield from all the wells was less than the yield of 646 during the first twenty-four hours after it commenced flowing. Many wells were abandoned, and the tools and machinery were being removed to other fields. Even under the discouragement of the rapid collapse of the district, however, new wells were being sunk. Probably the field will yield two or three thousand barrels a day for some years to come, from a hundred wells producing a few barrels each; but its importance has gone, and with it the fortunes of hundreds of eager speculative men, who rushed in to share the

SHOOTING A WELL.

profits of the big strike. With its partial failure, however, the price of oil has gone up, and prosperity has returned to the whole petroleum country. When crude oil brings ninety cents or a dollar a barrel, everybody is happy; when it goes down to fifty cents, times are hard, and nobody wears a cheerful face save the speculators who have sold "short."

The tools and appliances employed in sinking a well are few and simple. A derrick is first built of cheap hemlock lumber, and attached to it is a rude shed which shelters the steam-engine and the machinery for working the drill and sand-pump and for pumping the oil. Frequently the boiler is placed out-of-doors, without protection from the weather, and it usually stands at some distance from the derrick, so that it will not be injured in case the rest of the "rig" is destroyed by fire. The engine works a huge rude walking-beam which, by the movements of one arm, gives the motion to a stout cable, passing over a pulley at the top of the derrick, required to raise and lower the drill. Attached to the derrick is also a big windlass, called the "bull-wheel," which hoists the drilling apparatus out of the well. There is also a smaller windlass, called the sand-reel, which serves to lower and raise the sand-pump. After the rig is got upon the ground, a drive-pipe is forced down through the earth to the rock. The drilling tools consist of the "bit," which is a long bar of iron as heavy as a man can lift, with a sharp end to cut and pound the rock, the "auger stem," an iron bar perhaps

eight feet long screwed into the bit, the "jars," two heavy bars linked together, the "sinker-bar" resembling the auger stem, and the "rope-socket." All these implements, fastened end to end, reach nearly to the top of the derrick when hoisted out of the well. Then there is the "temper-screw," which lowers the drilling apparatus inch by inch as it goes down, and the "sand-pump" and "bailer," employed to take up and hoist out the pulverized rock and water. Once every six feet, in the progress of a well, the creaking bull-wheel is set in motion, the drilling apparatus is hoisted out, and the sand-pump (a cylinder with valves) is lowered and raised with the detritus. Frequently, the bit is unscrewed and sharpened at a forge under the derrick frame. Two or three men are sufficient to put down a well. The movements of the engine are controlled from the derrick by a simple apparatus of cords and wheels. When the well is down about three hundred feet, the "casing," a six-inch iron tube, is put in to keep the water from veins in the rock from getting into the well. When the oil-sand is struck, the oil, mingled with gas, spurts up with great force, perhaps as high as the derrick. Then the "tubing," two inches in diameter, is put in, and a "seed-bag" is forced down between it and the casing. The tubing runs to a tank several rods from the well, into which the oil flows as long as the well is a flowing well, and from which it is afterward pumped.

It costs about 80 cents a foot to sink a well by contract. The cost of a finished well, with apparatus complete, varies from $3000 to $4000, according to the depth at which the oil stratum is found and the expense of getting the engine and boiler on the ground. If a well proves a dry hole, or fails to yield enough oil to pay for pumping, and the owner removes the machinery to other ground for a fresh experiment, he is out of pocket from $1000 to $1500.

When a well is completed and productive the drilling apparatus is by no means useless. Occasionally the well must be cleaned out, or, perhaps, bored a little deeper. It does not always behave well, and it is necessary to find out what the matter is. In connection with the "outfit," as a Western man would say, must be mentioned the "sucker-rods," long sticks of ash coupled together and used in pumping, and the "fishing tools," which come into important service when the drilling apparatus or the rope breaks in the well.

When a well fails it is usually "torpedoed" to start the flow afresh. A long tin tube, containing six or eight quarts of nitro-glycerine, is lowered into the hole and exploded by dropping a weight upon it. The tremendous force of the powerful explosive tears the sand rock apart and loosens the imprisoned oil and gas. Nothing is heard on the surface save a sharp report like a pistol shot, but the ground heaves perceptibly, and pretty soon the oil comes spurting out in a jet that breaks in spray above the lofty derrick. The "torpedo man" is one of the interesting personages of the oil region who is seen with most satisfaction from a distance. He travels about in a light vehicle with his tubes and his nitro-glycerine can, traversing the rough roads at a jolly round trot, taking the chances of an accidental explosion, and whistling or singing as he goes. Sometimes the chances are against him, and a blow of a wheel against a stone sets free the terrible force imprisoned in the white fluid in his can. There is no occasion for a funeral after such an accident, for there is nothing to bury. Man, horse, and "buggy" are annihilated in a flash, and an ugly hole in the ground and a cloud of smoke are all that is left to show what has happened. The torpedo company buys a new horse and hires a new man, and there is no more difficulty about one transaction than the other. The business of "torpedoing" wells is in the hands of a single company, which has made a large amount of money from a patent covering the process of using explosives under a fluid. Most oil producers regard the patent as invalid, because nature supplies the fluid in the well into which the nitro-glycerine tube is lowered; but the courts have sustained the patent. Sometimes well-owners "torpedo" their wells stealthily by night to avoid paying the high price charged by the company. This operation is called "moonlighting," and many lawsuits have grown out of it.

In the whole Pennsylvania and New York field, the number of producing wells is at this time not far from 20,000, of which about 13,000 are in the Bradford district. The number of "dry holes" and exhausted wells no man has endeavored to compute. It is a common saying in the region, however, that since 1879 more money has been put into the ground than has been got out of it. No consideration of the general interest of the trade or of the risk involved in sinking new wells checks the business of boring. Production constantly runs ahead of consumption. It is useless for the newspapers in the oil country to show how much more prosperous the trade and all dependent upon it would be if the price of crude petroleum were kept up to a dollar a barrel, by limiting production. As soon as the price goes up high enough to be fairly remunerative, hundreds of new wells are sunk in old territory, and "wild-catting" becomes active.

A BURNING WELL AT CHERRY GROVE.

"Wild-catting" is the name applied to the venturesome business of drilling wells on territory not known to contain oil, in the hope of finding it. A man engaged in this pursuit is called not a wild-cat, but a "wild-catter." The typical "wild-catter" is a restless, speculative person, rich to-day and poor to-morrow, now making a lucky strike, and now sinking all his available means in a dry-hole. He has wonderful vitality, and never gives up. If "dead-broke," he will always manage to borrow money enough to sink "just one more well." When he begins to put down a wild-cat well, he usually leases all the land in the vicinity, agreeing to pay from one-eighth to one-fourth of the oil obtained if any is found. Should he make a strike, he sells his leases, for a handsome bonus, in tracts of five acres each, and pockets at once a large sum of money besides what he makes from his own well. Sometimes the "wild-catter," finding he has got a dry hole, secretly conveys a few barrels of oil to the spot in the night, empties them on the derrick platform and the ground, and manages to make a profit by selling his leases before the fraud is discovered. This operation corresponds to what is called "salting a mine" in the gold and silver regions of the far West.

Petroleum wells exist in India which are said to have been flowing for thousands of years. Doubtless the business of gathering the oil to serve some simple uses in its crude state is as old as civilization. Talking one day about the first discoveries of oil with a "wild-catter," on one of the narrow-gauge railway lines that run over the mountains and through the forests to reach the wells of Warren and McKean counties, the man said:

"Why, the oil business is no new thing. It's as old as the Scriptures. Job was an oil man. He struck the rock and it poured forth rivers of oil. He got rich in the oil business."

"Yes," chimed in a stranger on the other side of the car, "and that's the way he got his boils. I know men who can't be about oil wells without getting boils. They breathe in the carbon, and it goes into their blood."

The "wild-catter" agreed to this theory, and added that he had no doubt Job's wells took fire, burned up his children, and reduced him to poverty. As he was speaking, we saw a large column of inky black smoke rising above the forest to the right of the train. "A tank's on fire," said the brakeman. The news caused a movement of excitement in the car; some of the passengers went out on the platform, others put their heads out the windows, but the occurrence did not appear to be so unusual as to cause lasting interest. A curve in the road soon brought the train near the fire. A tank belonging to a well was burning with tremendous fury, making a great circular mass of rosy flame, and throwing up an enormous volume of smoke. It is no rare thing, I learned, for the small wooden tanks attached to the wells to take fire; but when one of the large storage tanks of the

Pipe Lines is struck by lightning, the spectacle is so magnificent that people gather from miles around to witness it. The owners make haste to bring a cannon by special train from the nearest town, and shoot holes in the tank to let the oil run out. None of it is saved, but if it is not released the tank boils over and bursts, and other tanks near by are ignited. Lightning is the great enemy of the big iron tanks.

Probably the most beautiful sight ever witnessed in the oil regions was that of the burning well in the Cherry Grove district last summer. A flowing well, yielding over a thousand barrels a day, took fire. The derrick was soon consumed, and the blazing fluid, spouting up high in the air and breaking in a shower of fiery drops, continued to burn for four days,— a wonderful fountain of fire in the midst of the forest. It was finally extinguished by shooting off the casing head with a cannon shot, and then applying an ingenious device for plugging the well below the fiery column.

The method of producing petroleum, as described above, has undergone but little change since the first wells were sunk in Oil Creek in 1859. The derrick is nearly twice as high as then; the drilling apparatus is much longer and heavier; there are improved implements for getting out the pulverized rock and water, and for fishing broken tools out of a well, and with the heavier apparatus now in use much less time is required to pierce to a given depth. Still the process is the same pounding of a hole through the rock, and the general appearance of a new well just sunk does not differ noticeably from that of a well of twenty years ago. It is in the means for the transportation and storage of the oil that great progress has been made. An admirable system has been developed in recent years, by which the product of widely scattered wells is gathered by small pipes into huge storage tanks, and then forced by powerful engines through larger pipes that run straight over hills and valleys, across forests, farms, and rivers, to the chief marts of refining and shipment. No other important product of industry is handled and transported with such small expenditure of labor and capital, and such rapidity and efficiency. The refineries of Pittsburg, Cleveland, and Buffalo are supplied by pipes from the heart of the producing regions in Pennsylvania, and the enormous tanks grouped on the hill-sides and in the valleys at Olean discharge their contents at Bayonne, on New York Bay, three hundred miles distant. A net-work of pipes covers the whole oil-producing territory, reaching every well, uniting all the isolated districts, and collecting the little streams of oil from twenty thousand different subterranean springs into rivulets and rivers that pulsate in their iron tubes like the arteries in the body of a living creature, and flow with powerful current straight to their appointed outlets.

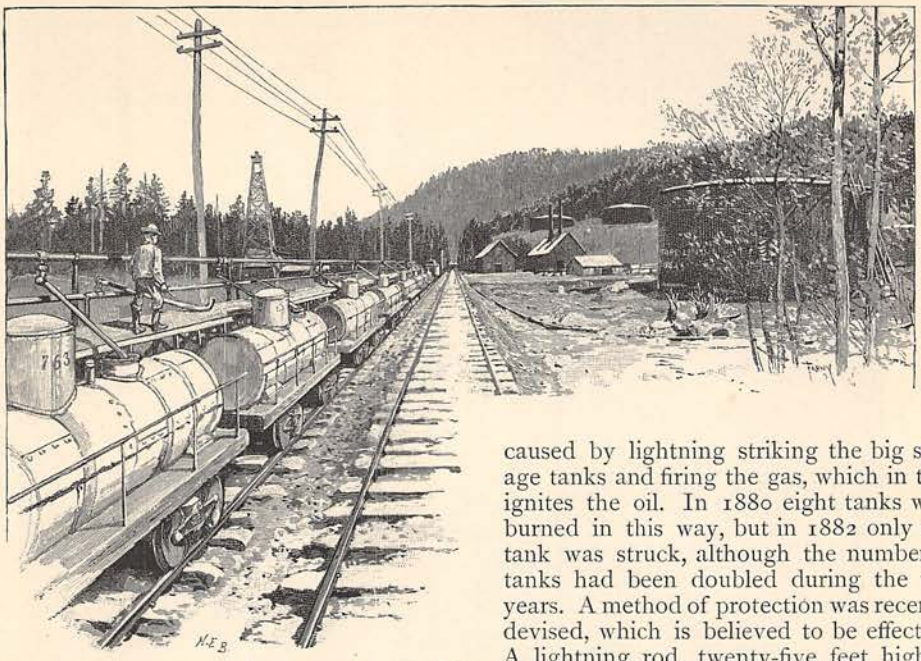
Two pipe-line companies supply the whole oil country with storage and transportation. One of these, the Tidewater Company, taps a portion of the wells in the Bradford field alone, and ends at Tamanend, in Eastern Pennsylvania, where it transfers its oil to tank cars on the Philadelphia and Reading Railway and the Central Railway of New Jersey. It is comparatively a small concern, but is important as the only competitor to its gigantic rival, the United Pipe Lines, a corporation running its mains to every district, large or small, in the oil region, having its termini at the sea-board and at the three principal refining cities of the interior, and possessing a tankage capacity of over thirty millions of barrels. The United Pipe Lines corporation is the great Standard Oil Company under a different name, the controlling interest in the stock of the two concerns being owned by the same men. The United stores and transports; the Standard buys, refines, sells, and exports. This double-headed corporate power is the monarch of the oil trade. Only the producing interest remains in a multitude of hands; all else is virtually concentrated in the grasp of a little group of men who manage the two companies.

Let us look for a moment at the system by which petroleum is handled. It is remarkably simple, inexpensive, and efficient. When the tank at a well is nearly full, notice is sent to the nearest agency of the Pipe Lines. A man comes promptly with a measuring pole and a little book of certificates. He gauges the oil in the tank, unlocks the stop-cock connecting with the outlet pipe, and lets as much oil run out as the well-owners want to dispose of. Then he shuts off the flow, measures what remains in the tank, and makes out a triplicate certificate, showing depth of oil at the beginning and at the end of the run. One he gives to the well manager who has signed with him, one he sends to the central office of the Pipe Lines at Oil City, and one he keeps. A telegram is then sent to the central office, giving notice that so many inches of oil have been run from the tank. Every tank has its number on the books of the company, and its capacity is recorded in inches. On receiving the certificate of the run, the number of barrels and hundredths of a barrel taken from the tank is ascertained by a table, and credit is given to the well for that amount of oil less three per cent., which is deducted for sedi-

A BURNING OIL-TANK. (CAPACITY, 3500 BARRELS.)

ment and evaporation. The account is not only kept in gross with the well, but is divided so that each share-owner, if there be many (and there are usually from three to a dozen), gets his separate credit for the amount of oil he is entitled to from the run. The United Pipe Lines is not only a transportation company, but also a bank of deposit for oil and an insurance company, and it keeps the books of every well it serves.

The oil from the well is now in possession of the Pipe Company, and is in one of its big storage tanks mixed with oil from scores of other wells. There is no separation and no distinction of quality. All crude petroleum, from whatever well or district it comes, is



OIL-SIDING AND PUMPING-STATION. TRANSPORTING OIL FROM THE PIPE-LINES TO THE CARS.

classed together as of uniform value. When a producer sells oil, he gives an order for a transfer to the purchaser of as many barrels from his credit balance as he has disposed of; or, if he wants to use his oil in store as collateral to borrow money upon or convert it into a negotiable certificate, he gets what is called an acceptance, which is virtually a certified check. These acceptances are issued in even amounts of one thousand barrels each. They are passed from hand to hand all over the world, but must, by a rule of the company, be sent in once in six months for renewal, or a double storage charge is made. Frequently they return covered on their backs with indorsements. When the holder of an acceptance or a credit balance wants the oil for use or shipment it is delivered at either of the main shipping points, he paying twenty cents per barrel as the pipage charge, and a storage charge of fifty cents per day per one thousand barrels. Storage for the first twenty days is free, however, to the producer, and a purchaser has ten days' storage without charge.

Insurance is a mutual affair. Losses are assessed on all the oil in the lines and on holders of acceptances and credit balances for oil in store. Last year the assessments amounted to only eight-tenths of one per cent. A loss of less than twenty thousand barrels is considered too small to assess, and is borne by the Pipe Company. Nearly all losses are caused by lightning striking the big storage tanks and firing the gas, which in turn ignites the oil. In 1880 eight tanks were burned in this way, but in 1882 only one tank was struck, although the number of tanks had been doubled during the two years. A method of protection was recently devised, which is believed to be effective. A lightning rod, twenty-five feet high, is attached to four broad bands of iron sheathing, reaching from the apex of the covered tank and out to the sides, and thus, according to the accepted theory, the electricity which the tank accumulates is safely discharged into the air.

The pipe line system was a thing of small beginnings and slow growth. As long ago as 1863 a young Boston attorney, who had established himself on the Tarr farm, one of the first producing districts on Oil Creek, conceived the plan of transporting crude petroleum through tubes, and had some pipe manufactured for the purpose, but never put it down. Two years later the first pipe was laid. It extended from Pithole to the Allegheny River, a distance of about fifteen miles, but the joints were so defective that it was used only a few weeks. It served to show, however, that the general plan of pipe transportation was practicable, and it was not long before a number of pipe companies were formed. Their object was only to take the oil from the wells to the nearest railway line or to the Allegheny River, on which it was then floated down to Pittsburg in tanks upon flat-boats. For a number of years the pipe lines were in bad odor, owing to numerous failures among the companies and to their lack of efficiency. The system gained ground, however, from its evident superiority, and in 1876 the consolidation of a number of lines formed the United Pipe Lines, a corporation which grew in power from year to year, and

finally absorbed all the old concerns. It now owns over three thousand miles of pipes and over five hundred iron tanks, with a storage capacity of from 20,000 to 35,000 barrels each.

A great deal of oil still goes to market by railroad however, not directly from the wells, but from shipping stations to which it is brought by the pipe lines. Tamanend and Williamsport are important shipping points, nearly two hundred miles from the oil fields; Kane, much nearer, is another, and there are numerous points where trains are loaded on the roads penetrating the producing districts. The long trains of tank cars, greasy, dirty, and malodorous, are familiar sights on most of the railways leading to New York, Philadelphia, and Baltimore. The tanks are cylindrical in form, holding about twenty-five thousand gallons each, and surmounted by a "cupola," which gives space for the oil to expand when heated by the sun's rays.

The long pipe lines are: Two from Olean on the northern verge of the great Bradford field to New York Bay, three hundred miles; one from Coal Grove in the Bradford field to Milton on the Philadelphia and Erie and Philadelphia and Reading railroads, about one hundred and fifty miles; one from Rock City in the same field to Buffalo, seventy-eight miles; one from Hilliard's, in the Lower field to Cleveland, one hundred and five miles; one from Carbon Center in the Lower field to Pittsburg, thirty-eight miles (all these belonging to the United Pipe Lines Company), and one from Rixford in the Bradford field to Tamanend on the Reading Railroad, one hundred and seventy miles, belonging to the Tidewater Company. There are also important lines connecting the different fields, so that oil can be transferred from one to another. On the main lines there is on an average a pumping engine every twenty-five miles. The engines may be much nearer together or much further apart, depending on the extent to which gravity can be used as a motive power. Main line pipes are four, five, or six inches in diameter. Through a six-inch pipe twenty thousand barrels a day can be conveyed. When oil is being forced through a pipe there is a constant clicking sound like that made by steam-heating apparatus. The hunter who loses his way in the dense forests which cover mountainous country in the oil regions will hardly go many miles without hearing this sharp, metallic sound; then he has only to follow the pipe to come to a cluster of wells, or a pumping station, or perhaps to a narrow-gauge railway climbing up a frightfully steep grade. The resonant pipe leads him out of the wilderness.

Every new producing district discovered in the oil regions develops one or more new towns. They spring up with marvelous rapidity, and bloom into full-grown municipalities in a few weeks, with stores, hotels, amusement halls, a fire department, and a police force. If the yield from the wells holds out for a year, the rude wooden structures are succeeded by brick blocks and comfortable dwellings; but most of these petroleum settlements never get beyond the shanty stage. Their decline is not so rapid as their rise, but their fortunes steadily fail as the yield of the district decreases. Some of them disappear altogether; others remain, shrunken and dilapidated, as insignificant centers of a little local trade. The magnitude of the producing business as a whole, however, and of the various interests of refining and transporting and of furnishing machinery and supplies dependent upon it, has recently developed a few important and prosperous little cities, whose existence does not hang upon the fate of any one particular district. The chief of these are Oil City, at the junction of Oil Creek with the Allegheny River, in what is known as in the Lower field, and Bradford in the Upper field. Oil City dates back to the first opening of wells on Oil Creek, and is a well-built place of about ten thousand inhabitants, wedged in two narrow valleys, dirty, smoky, and busy,— a railroad center, a large refining point, and the chief market for speculations and actual sales of crude petroleum. The chief offices of the United Pipe Lines and the most important oil exchange in the world are established here. Bradford was a petty country village in 1875, when oil was struck near by; now it rivals Oil City in population, and has a handsome exchange, an opera house, a street railroad, and two daily newspapers. The derricks stand thick among the houses, and dot the sides and crests of the steep wooded hills encircling the town. Railway lines run to every point of the compass, the narrow-gauge roads making no account of mountains, but getting up and over them on grades that would be impracticable to an ordinary train. Titusville, on Oil Creek, once the metropolis of the petroleum country, has lost its importance as a center of oil production and trade, but is the favorite residence town of prosperous brokers and producers, and boasts of its fine business buildings, well shaded streets, and handsome dwellings. It has a population of about five thousand. Warren, an old, quiet, county-seat town, with four thousand inhabitants, on the upper Allegheny, converted into an oil center by the opening of producing districts in its vicinity, is a pretty, homelike place, almost hidden under maple trees, and looking out

GAS WELLS.

from the river bluff on green meadows and the slopes of low mountains covered with hemlock and birch. In the still newer districts of Allegany County, New York (in Pennsylvania the name is spelled Allegheny, and in New York Allegany), the twin towns of Bolivar and Richburg, a mile apart, have together a population of over six thousand, and are equally unattractive, save where some vestiges of the original cross-roads villages remain. In their eager growth, even the homes of the dead have been invaded, and houses have been built in the old burying-grounds over and among the graves. Still less admirable in outward look are the last year's towns of Garfield and Farnsworth, sprawled out over forests and fields in the Cherry Grove district. These raw, rude, dusty, greasy centers of trade and speculation, born in a day of the excitement attending new discoveries of oil, strongly resemble the mining camps of Colorado and Montana. Like these camps, they are full of rough-looking, eager men, energetic and unkempt, bent upon making money by boldness and luck. Drinking-places abound, and the popular form of amusement is the vulgar variety show. There are old and orderly communities close at hand, however, and the laws are enforced without vigilance committees or Judge Lynch's courts. Open gaming is not allowed, and vice fears to flaunt itself in the highways. One does not meet such picturesque characters as are common in the mining districts. There is no element of personal danger, wildness, or remoteness, to attract adventurous spirits. The only peril is of getting "dead broke" in some unfortunate speculation. Telegraphs and railroads run everywhere, so the region is not a refuge, like the far Western Territories, for men who have run away from their creditors, from the sheriff, or from their wives. It looks wild and remote enough among the forests and mountains of northwestern Pennsylvania; but the great cities of Buffalo, Pittsburg, and Cleveland are only a few hours' distance by rail. The oil business is not of a character to attract romantic people. Washing gold from the earth is a dirty business; but the product is the precious, fascinating, yellow metal, while the occupation of boring for petroleum, though more hazardous so far as its chances of profit and loss are concerned than mining, yields only an ill-smelling liquid which sells at eighty or ninety cents a barrel.

Bradford and some of the smaller towns in the oil regions are lighted with natural gas

from wells which fail to yield oil, but discharge a steady flow of gas, not equal in illuminating power to good artificial gas, but so cheap that it is burned lavishly. To a great extent it is used as fuel, a supply pipe run into an ordinary coal stove being the only apparatus required. Were it not for a slight odor, it would be an ideal fuel. You have only to turn a stop-cock to regulate the heat, and there are, of course, no ashes or cinders or coal dust. Huge blazing torches, lighting up the woods for rods around and illuminating some lonely cabin or derrick with a theatrical stage glare, make weird night effects that startle the traveler, new to the oil country, who first traverses the great forests of the Bradford district.

A curious feature of the new settlements in the Cherry Grove district is the great number of shanties and sheds bearing the sign "Bottling Works." There are no saloons proper; but everywhere, on the dusty highways, at cross-roads, and in the woods, where there is a group of wells, this singular legend, "Bottling Works," greets the eye. The equipment of one of these establishments consists of two or three kegs and a dozen bottles of beer. No glasses are kept on the bar, and there are no seats for tired and thirsty wayfarers.

I stopped at one of these places and asked the proprietor, a decent looking fellow, to explain why he entitled his bar a bottling works instead of a beer saloon. He replied that the Pennsylvania license law empowered the courts to grant licenses. When oil was struck in Cherry Grove, the court in Warren county was not in session and would not sit for six months. Meanwhile, what should the thirsty multitude that rushed to the new field do for something to drink? Somebody remembered that there was a law authorizing every person who paid fifty dollars to the county treasurer to bottle ale or beer, not to be sold by the glass, and not to be drunk on the premises. The bottling works took shelter under this law. "You notice this platform in front of my house," continued the beer-seller. "Well, it's not on my premises. The house stands right on the line of the public highway. When I sell a customer a bottle of beer, he don't drink it on the premises; he stands right here on the porch, and the porch is in the highway."

Just then a red-faced man, whose clothes were redolent of petroleum, called for a bottle, swallowed the beer, put down ten cents, and went his way. "Don't you give them glasses to drink from?" I asked. "No; that would be selling by the glass. I got some tin cups and used them for awhile, but concluded I might get into trouble. The court might hold the tin-cup dodge as an evasion of the law. As long as they drink the beer from the bottle, the law can't touch me." "Then the effect of the liquor legislation is that a man who would ordinarily be satisfied with a mug of beer must buy a whole bottle?" "That's what it comes to, my friend."

The beer-seller went on to say that he voted for prohibitory laws every time. The more stringent a law was the better it suited him. "You see," he explained, "'taint every man that's got sand enough in him to violate such a law, and those who have can make lots of money. I always set up in a place where there's some sort of a strong local option or license law to stop the sale of drink. Men will have liquor, and when they are obliged to get it on the sly they'll pay a good price for it. I was two years in the town of Sharon, where they had local option. Even the druggists dursn't sell liquor. Well, I took a room, sub-leased it to a man to store brooms, so it didn't appear to be occupied by me, boarded up the window, made a little door in one pane, got myself a false face, and laid in a stock of whisky and pint bottles. When a customer rapped on the window I put on my mask, handed him out a pint bottle of whisky, and took in a dollar. Nobody could swear he got his liquor from me. I often made over a hundred dollars a day. The liquor cost me a dollar and a quarter a gallon, and I sold it for a dollar a pint. Finally they got a case against me in court. Some fellow swore he bought whisky from me. I got the case postponed six months, and went on selling. Then the jury disagreed. So I got six months' more time. At last I only had to pay a fine of fifty dollars."

Across the road from this man's bottling works was a neat country school-house, and near by, at a cross-roads, a big sign announced that the place was Vandergrift City. The brick buildings of a huge pumping engine sending a stream of oil off toward the seaboard and panting at its work, four huge tanks, and half-a-dozen houses made up the city. The beer-seller said he "located" there because the school was so convenient for his two little children.

The oil exchanges at Bradford and Oil City are noisy and animated places during business hours, and at other times they serve as club-rooms for the members. There are pleasant reading-rooms attached, where the daily papers from the large cities are received; and there are comfortable sofas and chairs, inviting to lounging and chat. In the Bradford Exchange there is also a music room with a piano, where of evenings the tuneful brokers sing popular ballads. The buying and selling

at these places is carried on with the clamor and gesticulation which, for some mysterious reason, is a feature of stock and produce exchanges the world over. Why men, who in all the other affairs of life are quiet and dignified, should think it necessary, when arranging a commercial transaction in stocks or grain or oil, to shout and shriek and wave their arms and shake their fists like raving lunatics, is a problem in human nature which remains unexplained. On a day when prices fluctuate, and the bulls and bears are peculiarly active and excited, the roar and racket from one of these oil exchanges can be heard a block distant. By far the greater part of the transactions are speculative, the oil nominally sold never changing hands at all, and never, in fact, being in the possession of either seller or buyer. The average daily sales at the Oil City Exchange in September last exceeded six million barrels; those at the Bradford Exchange exceeded two millions. I have not the figures for the other exchanges at Titusville, Pittsburg, and New York, but it is probably a moderate estimate to say that the grand total of daily transactions the year round averages ten million barrels, whereas the total production of the whole petroleum field is only about eighty thousand barrels per day. Petroleum is a peculiarly fascinating article for speculative operations, because of the heavy and frequent fluctuations in its value. Within the past year its price has ranged from forty-nine cents to one dollar per barrel. A variation of ten cents in a single day is no uncommon thing. The mere rumor of a successful well in a new district will sometimes send the price down five cents. No other great natural product is subject to such changes in value. The wheat crop and the cotton crop can be estimated months in advance, and one year's scant yield is compensated by the surplus of the next. The annual output of coal varies only with the demand, and there is no fear of the supply becoming exhausted. But with petroleum the case is different. No one can tell how long a well or a large group of wells will hold out. No one knows what new and untapped fountains the earth still conceals. The future of the oil business is not clear from week to week, much less from year to year. Perhaps the supply will so far fail as to send the price up to five dollars; perhaps new flowing wells will so increase the production as to make the oil worth little more than the cost of transportation from the tanks. The reader will see what a field these conditions afford for bold and reckless speculation and for large profits and losses.

The business of refining petroleum grew very naturally out of that of distilling kerosene from bituminous coal, which had developed into an important industry in the United States and Europe during the decade prior to the oil discoveries in Pennsylvania. The establishments using coal as a raw material from which to obtain kerosene substituted petroleum as soon as it became the cheaper of the two substances. The name coal oil was readily transferred to the new illuminating fluid obtained from the earth, and it is still widely known by that name or by the Greek appellation kerosene, originally taken as a trademark by one of the early distillers of cannel coal. It is an interesting fact, showing how persistently special industries cling to the localities of their first choice, that the great petroleum refineries of Hunter's Point, Long Island, whose odors are a serious offense to the noses of the inhabitants of the upper East River front wards of New York city, are the successors of one of the earliest kerosene factories in the United States, which was established on Newtown Creek in 1854.

The chief seats of the refining industry in this country are Cleveland, Buffalo, Pittsburg, Oil City, and Hunter's Point (now called Long Island City). With the exception of Oil City, all these places are situated at a considerable distance from the oil fields, and were chosen for convenience in domestic and foreign shipment of the refined product rather than for nearness to the supply of the crude material. The pipe system, however, brings them practically close to the wells. Most of the exports of petroleum go abroad in the shape of refined oil. There are, however, refineries in Europe, and notably in France, which buy large quantities of crude petroleum in America.

No fewer than ten substances are obtained from petroleum by the refining process besides the beautiful aniline dyes, which are extracted from the residuum by chemical processes. These substances, named in the order of their specific gravity, which varies from 625 to 848, are as follows: 1st, rhigolene, the most volatile product of first distillation used to produce local anæsthesia; 2d, gasolene, used in artificial gas machines; 3d, 4th, and 5th, three grades of naphtha, used for mixing paints and varnishes and dissolving resin; 6th, kerosene, the common illuminating oil of commerce; 7th, mineral sperm oil, a heavier oil for burning in lamps, which does not take fire under a temperature of three hundred degrees, and is employed on steamers and railroads; 8th, a lubricating oil for machinery; 9th, paraffine, from which candles are made; and 10th, paraffine wax. Then there is the residuum, usually called

coal tar, which has a variety of uses. In most refineries the products are only naphtha, kerosene, and residuum. The refining process removes the coloring matter and the gummy substances which would clog the lamp-wick and separates the naphtha, which makes the oil dangerously inflammable. The quality of refined petroleum depends on the care and honesty exercised in the distilling process. Good oil is not dangerous, as many people suppose all kerosene must be. Only the poorer grades are liable to take fire. A very simple test can be applied by any housekeeper to ascertain whether the fluid is safe or not. Partly fill a cup with water warmed to one hundred and twenty degrees Fahrenheit; turn in a little oil, stir the mixture, and apply a lighted match to the surface. If it takes fire, the oil is unfit for use; if not, it is entirely safe.

What is the future of the petroleum business? With a productive territory virtually confined to a few small strips and spots in six counties in Western Pennsylvania and New York, and an inexorable law of rapid exhaustion applying to all wells, the time would seem to be close at hand when this great blessing, the cheap light of the whole civilized world, would fail. Still, the history of the business in the short period since it began has been one of constant expansion. New fields have invariably been discovered when the yield of the old ones began to decline. Oil men have confidence that there is plenty of undiscovered territory yet to be found. Providence, they say, would not bestow so great a gift upon mankind to withdraw it when its use had become universal and the need of the human race for its benefits the greatest. Scientists may say that this view is based on an optimistic or pietistic theory of the universe that will not stand investigation. So far as the great stores of fuel and light, the coal and the petroleum, are concerned, it has, however, held good thus far. They have not failed. If the oil of the rock is destined to run dry, the chemists will perhaps be ready, by the time it is exhausted, to produce a cheap illuminator from water.

E. V. Smalley.

FAREWELL TO SALVINI.*

ALTHOUGH a curtain of the salt sea-mist
May fall between the actor and our eyes—
Although he change, for dear and softer skies,
These that the Spring has yet but coyly kist—
Although the voice to which we loved to list
Fail ere the thunder of our plaudits dies—
Although he part from us in gracious wise,
With grateful Memory left his eulogist—
His best is with us still.
His perfect art
Has held us 'twixt a heart-throb and a tear—
Cheating our souls to passionate belief:
And in his greatness we have now some part—
We have been courtiers of the crownless Lear,
And partners in Othello's mighty grief.

H. C. Bunner.

* Read at the Complimentary Dinner to Salvini, New York, April 26, 1883.