tion is given to the smaller steam piston contained in the cylinder, H, by an eccentric groove in the gear, Q; from this groove motion is transmitted by the arm, R, and the shaft it is keyed on, to the valve stem, worked by the vertical arm, S. Let us now turn to the means which admit the live steam to the main piston, and if we do so we shall see that there is a large iron disk, T, on the main shaft, which has a groove, U, formed on its edge by metallic strips; in this groove the rod, V, engages and (being fastened at the opposite end from the reader) moves the slide, W, as the piston revolves. On this slide there is an upright arm, X, on which the valve stems, D, heretofore-mentioned, are secured; they work through the small stuffing-boxes, seen in close proximity to them. The valves themselves are in the same chests as the reversing valves. The reversing valves are contained in either chest, and connected by side-rods to the cross-heads, Y—one in sight, the other invisible under the steam-chest. The handle projecting in front is provided for the purpose of changing the motion of the engine forward or backward by shifting the reversing valves either way.

We have thus described the principal details of this invention, and having exhausted the alphabet we shall proceed no further in this direction. The operation of the engine is very similar to all others. The piston (a single one fitted in a drum) revolves as the steam enters through the pipes, Z. When it nears the sliding partition the latter recedes and permits it to pass by, closing immediately thereafter. When the piston slides over the opening made by the secession of the partition, the packing in the end of it would strike the sharp edges were not some provision made to guard against such disaster. This is done by means of another cam (not seen in the engraving), which draws the packing into the piston and lets it rotate without injury. So also with the arrow-headed indicator and scale; the other end of this instrument works in a straight groove turned in the main shaft. If the lateral movement of the piston drum is too great it is immediately shown on an exaggerated scale by the indicator.

The inventor of this machine admits that it is very complicated, and thinks he could simplify it materially by making another. The steam leaked out considerably through the partition opening when we saw it in operation, caused, we were told, by defective workmanship. All the small cocks about the engine are provided for the purpose of drawing off the condensed water. The engine will, in our opinion, require much cutting down before it will be as efficient as it should be, and the hammering and pounding caused by the opening and shutting of the partition should be obviated as far as possible. This engine was patented on Sept. 3, 1861, by C. Christensen, of New York. One half of the patent has been assigned to C. and A. Hövet, corner of Myrtle and Carlton avenues, Brooklyn, N. Y.

THE PLAGUE OR "BLACK DEATH."

We have just received from Daniel E. Delavan, City Inspector of New York City, a copy of his annual report for 1862, which is of unusual interest. It contains a complete review of the sanitary condition of the city during that year, with much other matter relating to the causes of disease and sanitary reform. We thank Inspector Delevan for this report, which we regard as a most valuable contribution to sanitary literature. As an example of the interest which attaches to this volume, we refer the reader to the following graphic account of the "Plague":—

The "Black Death," or, as it was called in some countries, the "Great Mortality," was preceded by mighty revolutions in the organism of the earth, of which we have credible information. From China to the Atlantic, the foundations of the earth were shaken; throughout Asia and Europe the atmosphere was in commotion, and endangered, by its baneful influence, both vegetable and animal life.

The series of these great events began in the year 1333, fifteen years before the plague broke out in Europe; they first appeared in China. Here a parching drought, accompanied by famine, commenced in the tract of country watered by the rivers Kiang and Hoai. This was followed by such violent torrents of rain, in and about Kingsai, at that time the capital of the empire, that, according to tradition, more than 400,000 people perished in the floods. Finally, the mountain Tsincheon fell in, and vast clefts were formed in the earth. In the succeeding year (1334), passing over fabulous traditions, the neighborhood of Canton was visited by inundations; whilst in Tche, after an unexampled drought, a plague arose, which is said to have carried off about 5,000,000 people. A few months afterwards an earthquake followed, at and near Kingsai; and, subsequent to the falling-in of the mountains of Ki-ming-chan, a lake was formed of more than a hundred leagues in circumference, where, again, thousands found their grave. In Howkouang and Ho-nan a drought prevailed for five months; and innumerable swarms of locusts destroyed the vegetation, while famine and pestilence, as usual, followed in their train. Connected accounts of the condition of Europe before this great catastrophe are not to be expected from the writers of the fourteenth century. It is remarkable, however, that simultaneously with a drought and renewed floods in China, in 1336, many uncommon atmospheric phenomena, and in the winter frequent thunder storms, were observed in the north of France; and, so early as the eventful year of 1333, an eruption of Etna took place. According to the Chinese annals, about 4,000,000 of people perished by famine in the neighborhood of Kiang in 1337; and deluges, swarms of locusts, and an earthquake which lasted six days, caused incredible devastation. In the same year, the first swarms of locusts appeared in Franconia, which was succeeded, in the following year, by myriads of these insects. In 1338, Kingsai was visited by an earthquake of ten days' duration: at the same time, France suffered from a failure in the harvest; and, thenceforth, till the year 1342, there was in China a constant succession of inundations, earthquakes and famines. In the same year, great floods occurred in the vicinity of the Rhine, and in France, which could not be attributed to rain alone; for, everywhere, even on the tops of mountains, springs were seen to burst forth, and dry tracts were laid under water in an inexplicable manner. In the following year, the mountain Hong-tchang, in China, fell in, and caused a destructive deluge; and, in Pien-tcheou and Leang-tcheou, after three months rain, there followed unheard-of inundations, which destroyed seven cities. In Egypt and Syria, violent earthquakes took place; and, in China, they became from this time, more and more frequent; for they recurred in 1344, in Van-tcheou, where the sea overflowed in consequence, in 1345, in Hi-tcheou, and in both the following years in Canton, with subterraneous thunder. Meanwhile, floods and famine devastated various districts, until 1347, when the fury of the elements subsided in China.

The signs of terrestrial commotions commenced in Europe in the year 1348, after the intervening districts of country in Asia had probably been visited in the same manner.

On the island of Cyprus, the Plague from the East had already broken out; when an earthquake shook the foundations of the island, and was accompanied by so frightful a hurricane that the inhabitants who had slain their Mahometan slaves, in order that they might not themselves be subjugated by them, fled in dismay, in all directions. The sea overflowed—the ships were dashed to pieces on the rocks, and few outlived the terrific event, whereby this fertile and blooming island was converted into a desert. Before the earthquake, a pestiferous wind spread so poisonous an odor, that many, being overpowered by it, fell down suddenly, and expired in dreadful agonies. This phenomenon is one of the rarest that has ever been observed, for nothing is more constant than the composition of the air; and in no respect has nature been more careful in the preservation of organic life. Never have naturalists discovered in the atmosphere foreign elements, which, evident to the senses and borne by the winds, spread from land to land, carrying disease over whole portions of the earth, as is recounted to have taken place in the year 1348. It is, therefore, the more to be regretted, that in this extraordinary period, which, owing to the low condition of science, was very deficient in accurate observers, so little that can be depended on respecting those uncommon occurrences in the air should have been recorded.

Yet, German accounts say expressly that a thick, stinking mist advanced from the East and spread itself over Italy; and there could be no deception in so palpable a phenomenon.

The credibility of unadorned traditions, however little they may satisfy physical research, can scarcely be called in question when we consider the connection of events; for just at that time earthquakes were more general than they had been within the range of history. In thousands of places chasms were formed, from whence arose noxious vapors; and, as at that time natural occurrences were transformed into miracles, it was reported that a fiery meteor, which descended on the earth far in the East, had destroyed everything within a circumference of more than a hundred leagues, infecting the air far and wide. The consequences of innumerable floods contributed to the same effect, vast river districts had been converted into swamps; foul vapors arose everywhere, increased by the odor of putrified locusts, which had never perhaps darkened the sun in thicker swarms, and of countless corpses, which, even in the well-regulated countries of Europe, they knew not how to remove quickly enough out of the sight of the living. It is probable, therefore, that the atmosphere contained foreign and sensibly perceptible admixtures, to a great extent, which, at least in the lower regions, could not be decomposed, or rendered ineffective by separation. Pursuing the course of these grand revolutions further, we find notice of an unexampled earthquake, which, on the 25th of January, 1348, shook Greece, Italy, and the neighboring countries. Naples, Rome, Pisa, Bologna, Padua, Venice, and many other cities suffered considerably. Whole villages were swallowed up, castles, houses and churches were overthrown, and hundreds of people were buried beneath their ruins. In Carinthia, thirty villages, together with all the churches, were demolished; more than a thousand corpses were drawn out of the rubbish; the city of Villach was so completely destroyed that very few of its inhabitants were saved; and, when the earth ceased to tremble, it was found that mountains had been moved from their positions, and that many hamlets were left in ruins. It is recorded that, during this earthquake, the wine in the casks became turbid, a statement which may be considered as furnishing a proof that atmospheric changes, of a character hitherto unknown, had taken place; but if we had no other information from which the excitement of conflicting powers of nature, during these commotions, might be inferred, yet scientific observations, in modern times, have shown that the relation of the atmosphere to the earth is changed by volcanic influences. Why, then, may we not, from this fact, draw retrospective inferences respecting those extraordinary phenomena? Independently of this, however, we know that, during this earthquake, the duration of which is stated by some to have been a week and by others a fortnight, people experienced an unusual stupor and headache, and that many fainted away.

These destructive earthquakes extended as far as the neighborhood of Basle, and recurred, until the year 1360, throughout Germany, France, Silesia, Poland, England and Denmark, and much further north.

Great and extraordinary meteors appeared in many places, and were regarded with superstitious horror. The order of the seasons seemed to be inverted; rains, floods, and failures in crops were so general that few places were exempt from them; and though an historian of that century assures us that there was an abundance in the granaries and storehouses, all his cotemporaries, with one voice, contradict him. The consequences of failure in the crops were soon felt, especially in Italy and the surrounding countries, where, in this year, a rain which continued for four months, had destroyed the seed. In the larger cities they were compelled, in the spring of 1347, to have recourse to a distribution of bread among the poor, particularly at Florence, where they erected large bake-houses, from which, in April, ninety-four thousand loaves of bread, each of twelve ounces in weight, were daily dispensed. It is plain, however, that humanity could only partially mitigate the general distress, not altogether obviate it.

Diseases, the invariable consequence of famine, broke out in the country, as well as in cities; children died of hunger in their mothers' arms; want,

misery, and despair were general throughout Christendom.

Such are the events which took place before the eruption of the Black Plague in Europe. Cotemporaries have explained them after their own manner, and have thus, like their posterity, under similar circumstances, given a proof that mortals possess neither senses nor intellectual faculties sufficiently acute to comprehend the phenomena produced by the earth's organism, much less scientifically to understand their effects. Superstition, selfishness in a thousand forms, the presumption of the schools, laid hold of unconnected facts. They vainly thought to comprehend the whole in the individual, and perceived not the universal spirit which, in intimate union with the mighty powers of nature, animates the movements of all existence, and permits not any phenomenon to originate from isolated causes. To attempt, five centuries after that age of desolation, to point out the causes of a cosmical commotion, which has never recurred to an equal extent—to indicate scientifically the influences which called forth so terrific a poison in the bodies of men and animals, exceeds the limits of human understanding. If we are even now unable, with all the varied resources of an extended knowledge of nature, to define that condition of the atmosphere by which pestilences are generated, still less can we pretend to reason retrospectively from the nineteenth to the fourteenth century; but if we take a general view of the occurrences, that century will give us copious information, and, as applicable to all succeeding times, of high importance.

In the progress of connected natural phenomena, from east to west, that great law of nature is plainly revealed which has so often and evidently manifested itself in the earth's organism, as well as in the state of nations dependent upon it. In the inmost depths of the globe, that impulse was given in the year 1333, which, in uninterrupted succession for six and twenty years, shook the surface of the earth, even to the western shores of Europe. From the very beginning the air partook of the terrestrial concussion; atmospherical waters overflowed the land, or its plants and animals perished under the scorching heat. The insect tribe was wonderfully called into life, as if animated beings were destined to complete the destruction which astral and telluric powers had begun. Thus did this dreadful work of nature advance from year to year; it was a progressive infection of the zones, which exerted a powerful influence both above and beneath the surface of the earth; and, after having been perceptible, in slighter indications, at the commencement of the terrestrial commotions in China, it convulsed the whole earth.

The symptoms of this fearful disease, like all others, were not always the same; accordingly we find some patients struck down almost as by lightning and die upon the spot, while others were attacked with a violent pain in the head, followed by stupor, finally falling into a deep sleep, losing their speech from palsy of tongue; others remained sleepless and without rest. The tongue and throat were often black and swollen, with blood exuding, the tumefaction being so great that neither drink nor food could be taken, the thirst and suffering continuing without alleviation until terminated by death. Others would be seized with violent inflammation of the lungs, accompanied with a terrible pain in the chest, which would soon be followed with profuse expectoration of blood and pestiferous odor of the breath. Some would have an ardent fever from the beginning, accompanied by an evacuation of blood; these patients usually died in about three days. When the patient survived the first attack, large buboes in the groin and under the arm and inflammatory boils all over the body made their appearance.

In Egypt, the symptoms were inflammation of the lungs, with burning heat, and expectoration of blood, which destroyed quickly and infallibly. In Florence it commenced, not as in the East, with bleeding from the nose, a sure sign of inevitable death; but there took place, at the beginning, both in men and women, tumors in the groin and in the axilla, varying in circumference up to the size of an egg, and called by the people pest-boils. Then there appeared similar tumors indiscriminately over all parts of the body, and black or blue spots came out on the arms or thighs, or on other parts, either single and large, or small and thickly studded. These spots proved equally fatal with the pest-boils, which from the first had been regarded as a sure sign of death. No power of medicine brought relief—almost all died within the first three days, some sooner, some later, after the appearance of these signs, and for the most part entirely without fever or other symptoms.

So universal was this disolve that it even attacked and destroyed large number of animals. Boccacio saw two hogs, lying on the rags of a person who had died of plague, and after staggering about for a short time they fell dead, as if they had taken poison. In other places, multitudes of dogs, cats, fowls, and other animals, fell victims to the contagion. In England a fatal murrain took place among cattle. Wandering about without herdsmen, they died by thousands.

We have no certain measure by which to estimate the ravages of the black plague, definitely, from a want of knowledge of the amount of the population; and, moreover, the traditional statements of the amount of this loss are so vague, that there is only room for probable conjecture. I will therefore confine myself to exhibiting some of the more credible accounts relative to European cities, and of some other places, that are regarded by historians as being reliable:—

In Florence there died of Black Plague	60,000
In Venice	100,000
In Marseilles (in one month)	16,000
In Siena	70,000
In Paris	50,000
In St. Denys	14,000
In Avignon	60,000
In Strasburgh	16,000
In Lubeck	9,000
In Basle	14,000
In Erfurt, at least	16,000
In Weimar	5,000
In Limburg	2,500
In London, at least (in 1664)	68,596
In Norwich	51,100

To which may be added—

Franciscan Friars in Germany	124,434
Minorites in Italy	30,000

This short catalogue could be further multiplied, but would still fail to give a true picture of the depopulation which took place. Lubeck, at that time the Venice of the North, which would no longer contain the multitudes that flocked to it, was thrown into such consternation on the eruptions of the plague, that the citizens destroyed themselves, as if in frenzy. Merchants, whose earnings and possessions were unbounded, coldly and willingly renounced their earthly earnings. They carried their treasures to monasteries and churches, and laid them at the foot of the altar; but gold had no charms for the monks, for it only brought them death. They shut their gates; yet, still it was cast to them over the convent walls. In some place the church-yards were soon unable to contain the dead. They were then arranged in layers, by thousands, in large pits outside the cities. In Avignon, the Pope found it necessary to consecrate the Rhone, that bodies might be thrown into the river without delay, as the church-yards would no longer hold them. It many places, it was rumored that plague patients were buried alive, as may sometimes happen through senseless alarm and indecent haste. Morals were deteriorated everywhere, and the service of God was, in a great measure, laid aside. The instruction of the people was impeded, covetousness became general; and when tranquillity was restored, the great increase of lawyers was astonishing, to whom endless disputes, regarding inheritances, offered a rich harvest. The sittings of Parliamant, of the King's Bench, and most of the other courts were suspended as long as the malady raged. The laws of peace availed not during the dominion of Death.

Cairo lost, daily, when the plague was raging with its greatest violence, from 10,000 to 15,000. In China, more than 13,000,000 are said to have died. India was depopulated. The kingdom of Tartary was covered with dead bodies. In Caramania and Cesarea, none were left alive. On the roads, in the camps, in the caravansaries, unburied bodies alone were seen. In Aleppo, 500 died daily; 22,000 people, and most of the animals, were carried off in Gaza, within six weeks. Cyprus lost almost all its inhabitants; and ships without crews were often seen in the Mediterranean, as afterwards in the North Sea, driving about entirely unmanned.

It was reported that, throughout the East, excepting China, 23,840,000 people had fallen victims to the Plague. In all Germany, 1,244,434 were calculated to have died. Of all the estimates of the number of lives lost in Europe, the most probable is, that, altogether, a fourth part of the inhabitants were carried off.

It may, therefore, be assumed, without exaggeration, that Europe lost, during the Black Death, 25,000,000 of inhabitants. The inhabitants of Iceland and Greenland found, in the coldness of their inhospitable climate, no protection against the southern enemy who had penetrated to them from happier countries. The Plague caused great havoc among them. In Russia, the mortality was extraordinarily great, and the same scenes of affliction and despair were exhibited as had occurred in other countries.

The mental shock sustained by all nations, during the prevalence of the Black Plague, is without parallel, and beyond description. In the eyes of the timorous, danger was the certain harbinger of death; many fell victims to fear on the first appearance of the distemper, and the most stout-hearted lost their confidence. Thus, after reliance on the future had died away, the spiritual union, which binds man to his family and his fellow-creatures, was gradually dissolved. The pious closed their accounts with the world—eternity presented itself to their view—their only remaining desire was for a participation in the consolations of religion, because, to them, death was disarmed of its sting.

A lively image of the Black Plague and of the moral evil which followed in its train will vividly represent itself to persons acquainted with nature and the constitution of society. Almost the only credible accounts of the manner of living, and of the ruin which occurred in private life, during this pestilence, are from Italy; and these may enable us to form a just estimate of the general state of families in Europe, taking into consideration what is peculiar in the manners of each country. "When the evil had become universal," says an old writer, speaking of Florence, "the hearts of all the inhabitants were closed to feelings of humanity. They fled from the sick and all that belonged to them, hoping by these means, to save themselves. Others shut themselves up in their houses with their wives, their children, and households, living on the most costly food, but carefully avoiding all excess. None were allowed access to them; no intelligence of death or sickness was permitted to reach their ear; and they spent their time in singing and music, and other pastimes. Others, on the contrary, considered eating and drinking to excess, amusements of all descriptions, the indulgence of every gratification, and an indifference to what was passing around them, as the best medicine; and they acted accordingly—they wandered day and night from one tavern to another, and feasted without moderation or bounds. In this way they endeavored to avoid all contact with the sick, and abandoned their houses and property to chance.

"Amid this general lamentation and woe the influence and authority of every law, human and divine, vanished. Most of those who were in office had been carried off by the plague, or lay sick unable to attend to their duties."

The Plague in London is thus described:—"Vast numbers of people fled in panic terror from that fatal city; servants and work-people were discharged in great numbers; commerce was paralyzed; few ships ventured up the river, and merchant vessels were occupied by their owners as asylums on the water. Sextons, grave-diggers, bearers, bellmen, and drivers of death-carts were in demand. The dead were buried indiscriminately; some bodies lay in forsaken houses, others across the paths in the streets, no longer traversed by carts or coaches. At the end of the summer, grass was growing in Bishopsgate street and Cornhill, where the people thronged no longer. The loud voices, shrieks, and sobs of the delirious, the desolate, and the dying were heard in the streets, at times, too, disturbed by reckless travelers and by raving patients, who had escaped from their dwellings, converted into prisons; for, according to the regulations, 'infected houses' were shut up, a red cross, and 'Lord have mercy upon us!' were inscribed on their portals, while watchmen jealously guarded the doors. These quarantine regulations were at first rigidly carried out, and were only gradually abandoned when they were found useless, pernicious, and impracticable."

Gas from Petroleum.

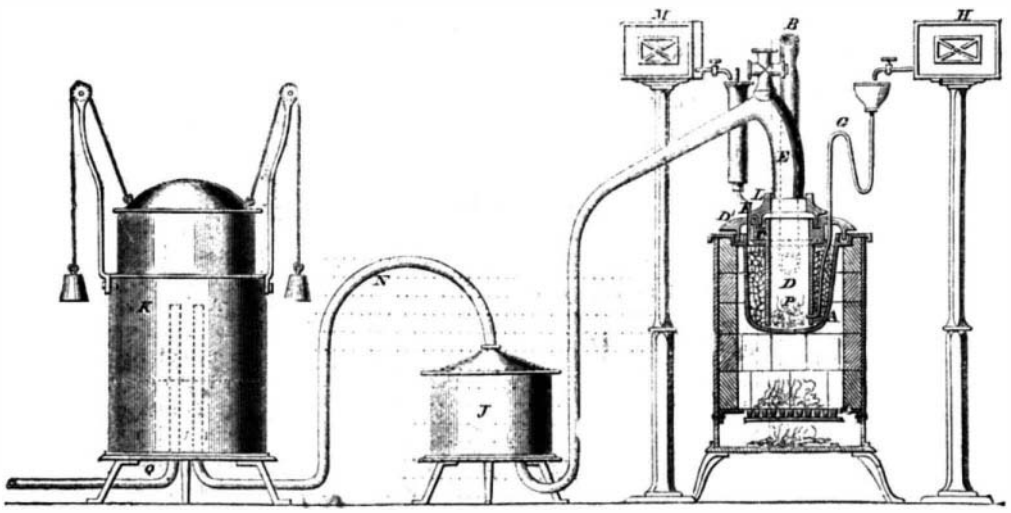
Gas is the most beautiful and convenient system of artificial illumination, and in cities and large villages it is, perhaps, the cheapest light; but illuminating gas may be made from quite a variety of substances, and different circumstances may rule the choice of these for objects of economy. Where good coal is cheap, or even moderately cheap, and the quantity of gas required is large, coal, thus far, has been found to be the cheapest gas material. In some situations resin has been used as the most suitable substance for making gas, but as this material cannot now be obtained in sufficient quantities, petroleum has been proposed as a substitute. The great abundance and general low cost of this material has also raised a question lately, whether it may not take the place of coal as well as resin. And in combination therewith the gas of decomposed water has been proposed to secure more economical results.

The accompanying engraving represents an improved gas-making apparatus based upon the above ideas, patented by J. E. Thomson, of Buffalo, N. Y., on May 20th, last year; the description is copied from the patent. A represents the vertical section of a portable retort having a fire-chamber with an attached chimney, B. The furnace is surmounted by a hemispherical retort, C, which includes a central hollow cylinder, D, open at the bottom and connected at the top with the eduction pipe, E. The lid, L, fits tightly over the cylinder, D, by sealed joints. The rim, D′, is cast with the cylinder, and forms a cover to the furnace, fitting thereon by sealed joints. The eduction pipe, E, fits tightly into the top of the inner cylinder. A pipe, F, conducts the petroleum from the reservoir, M, into the retort. This pipe is continued around the body of the cylinder, D, within the retort, as shown by the dotted lines, and it has numerous holes in it for the petroleum to percolate and drop into the retort. A siphon is represented at C, for conducting water from a reservoir, H, into the cylinder, D. It opens into it in such a manner that the water will spirt upon the red-hot coke or charcoal, or upon lumps of fire-brick contained in an enlargement of the pipe within the cylinder. J represents a purifying vessel, into which the eduction pipe, E, leads. Hydrochloric acid, diluted with water, is used in this vessel for deodorizing or purifying the gas. After the hydrochloric acid is mixed with the water in the washing vessel, the process of washing and purifying is conducted in the usual manner. K represents a gasometer of usual construction connected with the washing vessel by the pipe, N, the gas passing from the purifier through the pipe to the gasometer. The gas is taken from the gasometer through the main pipe, Q, to the burners. The cylinder, D, is filled (or nearly so) with coke or charcoal, as shown at P, and the space between the retort and the cylinder is filled with fire-brick.

Operation.—The apparatus being constructed and prepared as described, when the retort becomes red-hot, crude petroleum is allowed to flow from the reservoir, M, through the pipe, F, and trickle down upon the fire-brick within the retort (and upon the red-hot surface of the coke and retort.) The oil then decomposes into gas and volatile hydrocarbons, which pass through the interstices of the fire-brick and through the lower open end of the cylinder into the interior, where they combine and mix with the gases from the water. The water is allowed to flow from the reservoir, H, through the siphon pipe, G, and as it falls upon the red-hot charcoal or fire-brick, it is instantly changed and decomposed in the nascent state by contact with heated hydro-carbon vapor into permanent illuminating gases, and into gases (hydrogen, carbonic oxide and carbonic acid) which also pass up the cylinder, D, and eduction pipe, E, and then mingle and combine with the petroleum gases, forming a new combination gas of great illuminating power, which is purified and used as described. The retort must be kept at a red heat during the process. This process differs from those of White, Barlow, Gore and Sanders, in which water is employed as one of the agents for producing the gas. In this process the water is thrown into a spheroidal condition, and acts nascently upon the volatile hydro-carbon vapors, and converts them into permanent gases, thus preventing the condensation of hydro-carbon vapors.

The "claim" is for the manufacture and use of an illuminating gas produced by a combination of petroleum or other hydro-carbon gases—petroleum being preferred—with combination gases produced by the action of water in a spheroidal state on hydro-carbon vapors, substantially as described.

The use of water gas for illumination has never impressed us favorably. Theoretically it is a disadvantage; practically it has never yet been successful. In a few instances it has been employed with apparent good results for a short period. Its triumph has been heralded far and wide; its failure never reported by friends or dupes. Good gas may be obtained from pure petroleum, but its economy will depend upon its relative price compared with coal. In some situations near the oil wells petroleum may reasonably be expected to produce the cheapest gas, and it may be made in a retort like the one here represented, without its water arrangement. From several experiments made with petroleum, John Reid, of the Edinburgh and Leith Gas Works, Scotland, states in a letter to the London *Gas Light Journal* that he obtained 109 cubic feet of gas from a gallon of petroleum; the retort used being nearly similar to the one illustrated. It contained coke and bricks. A tun of medium cannel coal will yield 10,000 cubic feet of gas. Dr. Frankland has made experiments with different illuminating agents to test their light-giving power and relative cost. To produce the same amount of light, one gallon of Young's paraffine (coal) oil is set down as 1; American petroleum, 1.26; and these quantities gave a light equal to 26.4 pounds of wax candles; 22.9 pounds of sperm; 27.6 of stearic, and 36 of tallow. The relative cost in London was, for twenty spermaceti candles, burning ten hours, 6*s.* 8*d.*; tallow, 2*s.* 8*d.*; coal gas giving the same quantity of light, 4½*d.*; coal oil, 6*d.*; petroleum, 7¾*d.* With respect to such results Dr. Frankland says:—"In an economical point of view, petroleum and paraffine oil approach gas very closely indeed, while the enormous quantities in which they are now being produced, cannot fail to make them still lower in price. Therefore we may look upon them as most formidable rivals to gas light." These remarks have reference to their use in lamps.



PETROLEUM GAS-MAKING APPARATUS.

Bursting of a Fly-wheel.—A fly-wheel recently burst in the rolling-mill of Verree & Mitchell, Philadelphia, Pa. The wheel was twenty feet in diameter, and weighed nearly twelve tuns. The rim was broken into three pieces, two of which went through the roof, and the third piece landed on the boiler. The damage done will amount to nearly $1,500. The accident will stop the work in the mill for ten days or two weeks.

The Soldier's Mania — Coffee.

Coffee is the soldier's luxury, deprived of which he imagines himself the worst-used individual that he is capable of conceiving. On a march, for convenience sake, the coffee and sugar are mixed together. Every man carries his tin cup or can for making his coffee, and he would as soon think of leaving his musket as the cup wherein to make his coffee. The new regiments come out very well supplied with cups, but the old soldier disdains buying a cup, and manufactures a much better one for himself. Taking one of the cans in which fruits and vegetables are preserved (and which every sutler has a full assortment of), he cuts the top entirely out, and with a piece of wire cut from some abandoned or destroyed telegraph line, he makes of it a handle (technically a "bail") and his coffee pail is complete. The moment a halt is made, the soldier commences making his coffee. Some water from his canteen or a neighboring brook or spring is soon boiling briskly over a little fire of glowing embers. Upon this boiling water he pours his coffee and sugar, and by the time the coffee has settled to the bottom and the sugar is dissolved, the beverage is ready for use. Coffee-drinking is a passion with soldiers which amounts to a mania. A five minutes' halt on a march, and a soldier must have his coffee. If he straggles behind and escapes the provost guard, he sits down and contentedly makes his coffee. If he strays off the road to some of the "hospitable mansions" (?) by the road side, his first request is to be allowed to make a little coffee in the fire-place; and on halting for the night, no matter how tired he may be, he cannot by any possibility spread his blanket until he has enjoyed his cup of hot coffee. The immoderate use of coffee is productive of much of the diarrhœa of the camp, but, taken in reasonable quantities, such an effect would rarely be produced. Attempts have been made to substitute tea for coffee, but with no success. Soldiers think more of their coffee than all the rest of their rations. They do not like tea; and though, when issued in lieu of coffee, they will use it, yet they grumble not a little at the substitution.—*Medical Reporter.*

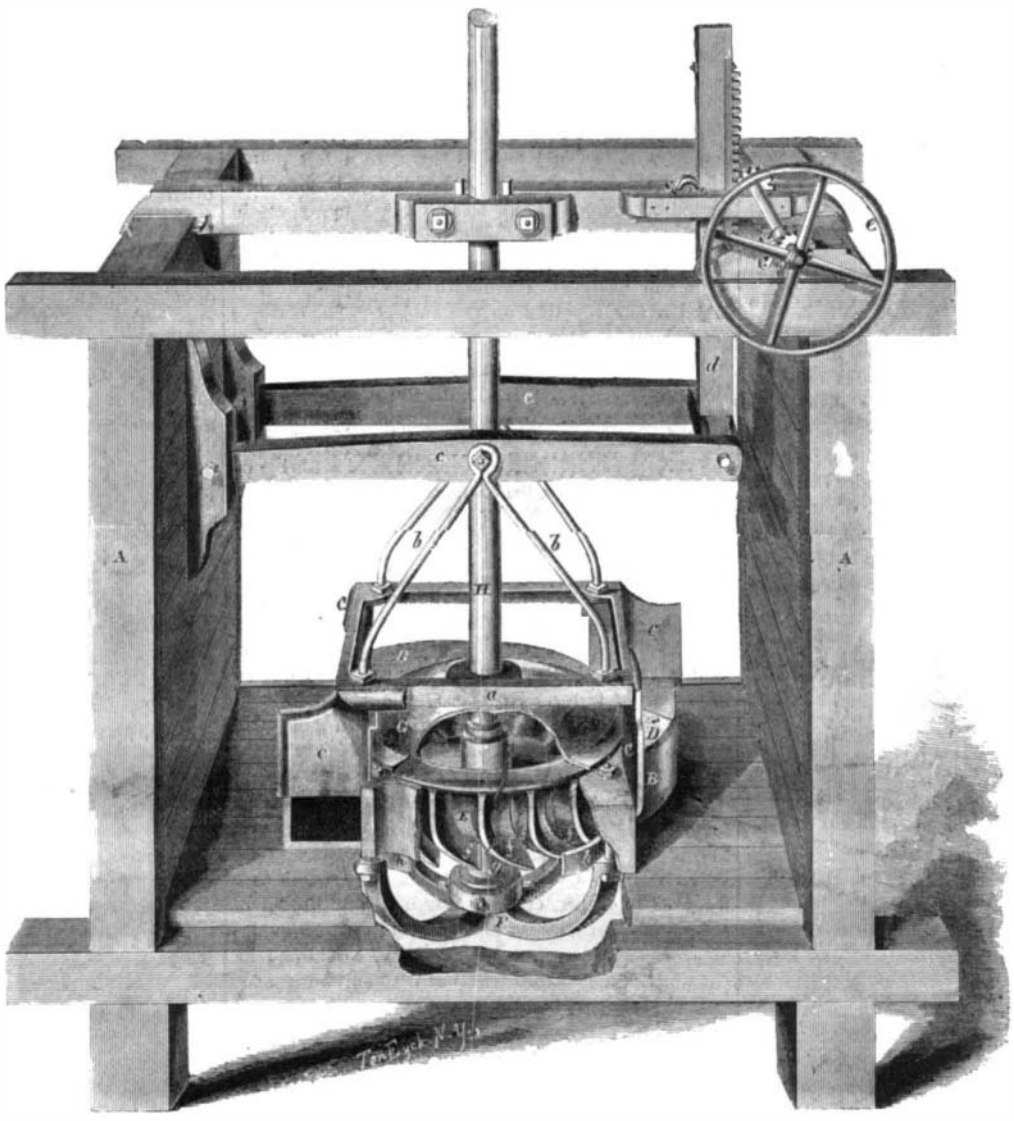
A New Comet.

A comet was discovered in France about the middle of last April, the following approximate elements of which were communicated to the London *Times* of the 18th ult., by that eminent astronomer, J. R. Hind, Esq. Mr. Hind states they were deduced from observations at Paris on April 14th, and at Florence on April 15th and 16th. Perihelion passage, March 22d—8 P. M.—M. T. Greenwich. Longitude of perihelion 261° 11′; longitude of node 244° 25′; inclination 86° 34′; least distance from the sun 0.9,899; motion retrograde. Mr. Hind remarks that this appears to be a comet not previously computed. Its distance from the earth on April 17, was about 67 millions of miles, or 7-10ths of our distance from the sun, but the distance for a few days would slowly diminish; the brightness of the comet, however, would not probably increase. On April 18, 12 hours, M. T. G., the A. R. of comet was 20h. 29m; declination 12° 22′ North. April 22, 12 hours, A. R. 20h. 23m; declination 21° 58′ North.

A Musical Bed.—Foreign journals speak of an invention just produced in Germany, namely, a musical bed, so constructed that, by means of a concealed piece of mechanism, the pressure of the body produces the softest harmony, which lasts long enough to lull one to sleep. At the head of the bed is a dial with a hand which can be placed at whatever hour the person wishes to awake; and at the time fixed the bed plays a march of Spontini, with drums and cymbals, loud enough to wake the soundest sleeper.

Improved Water-wheel.

This wheel is one of a class of water motors which have come into extensive use of late years. They are extremely simple in their action and construction, and involve no more attendance than an ordinary wheel. In addition to these qualities they give out a large amount of power in comparison with their size and amount of water applied. Our engraving shows the wheel (part of the chutes being broken away), set in the large wooden penstock, A, and has attached to the chutes, B, four gates, C, which open or close the chutes; these gates are connected together by a square frame (*a*); from the corners of the latter, four wrought iron rods, *b*, proceed, which are fastened at the top to the transverse wooden bars, *c c*, by means of the lever, *d*. When these bars are raised they carry the gates with them, and consequently start the wheel. Inside of the broken chute, B, may be seen the wheel, E; it consists of a concave hub, keyed fast to the shaft, *e*, having the buckets, *f*, secured to its periphery by four bolts in each, so that in case of breakage new buckets can be substituted for the damaged ones. By this shape of the hub and bucket, the water first acts directly on the upper or straight part of the bucket, and then by the concave hub it is passed down to the lower or curved part, and acts by its gravity, the step, *g*, is also relieved of a part of the superincumbent weight, by the conformation of the hub. The cover, G, is secured to the top of the four chutes by bolts and is turned out in the center to fit the shaft, H, which prevents any leakage. This wheel is made solely of cast and wrought iron (except the step), and is accurately turned and fitted in all its parts; it is the invention of N. F. Burnham, of Laurel Factory, Maryland, and was patented through the Scientific American Patent Agency, on Feb. 22, 1859; further information can be had by addressing the patentee, N. F. Burnham, Variety Iron Works, York, Pa.



BURNHAM'S PATENT TURBINE WATER-WHEEL.

Training Fruit Trees in Gardens.

The following remarks relating to the training of fruit trees are condensed from the address of Mr. George Laing, before the Canadian Board of Agriculture, and published in the journal of that board:—

"There are various forms in which the fruit tree is trained for the open garden and orchard. All varieties, either of the pear, the apple, or other kinds of fruit, are not all eligible alike for pyramids and bushes as they are termed. Some incline to grow compact and neat, others horizontally or bushy, and some very thin and slender. Whatever the fancy may be, as to the shape that the tree is to be trained, the varieties best suited should be selected; those of compact, erect habit are the best for pyramids; the horizontal growers, or those of a crooked nature, for bushes; the thin and slender growers, of whatever shape they are to be, require to be well attended to when young, as they are all, with few exceptions, apt to be furnished with dormant buds on the lower part of the branches; this, by early short pinching may be greatly obviated. It is very desirable to have all trees that are purposed to be of small stature on dwarf stocks—the pear on the quince, the apple on the English crab and Paradise stock, the plum on the sloe, the morella and duke cherries on the mahaleb, the bigarreau and heart cherries on the common cherry stock. The pear, the apple, the cherry and all of the other varieties mentioned are well adapted for dwarf culture, which has been admitted, by all who have practiced it extensively, to be the most interesting and the best. The plum in a rich soil rapidly forms a pyramid; it can scarcely be managed by summer pinching, as it is of such a rapid growth. It is, however, a tree whose roots keep near the surface, and can easily be kept down by annual or biennial root-pruning, whichever may be adopted. Cut all the roots, and as the tree advances and years roll on, every time the roots are pruned, cut within a few inches of the former stump. Some cultivators approve of removing the trees annually, if the soil be rich; biennially and adding some rich composts, if it be poor. This is to be done without root pruning, commencing the second year after planting, performing the operation in the end of October or the beginning of November, as the tree may be found in condition. Lift them carefully, preserving all the roots unless any stragglers; then make the hole, from whence the tree was moved, a little deeper and of sufficient breadth to receive the roots at full length; place a little of a prepared compost of loam and rotten dung in the bottom, then place the tree in the center and carefully spread out all the roots and cover them over with a little of the compost; when that is done fill in the common earth and tread it down firmly with the foot, then mulch all over.

"Summer pinching is an essential operation. It is done by the finger and thumb, and by a timely use of them the tree may in a great measure be summer pruned. In exemplifying this operation, take a young pear tree of one year from the bud or graft, say for a pyramid. A good, well-rooted plant, with a single upright stem well furnished with buds, should be selected. In the first spring head it down to within eighteen inches of the ground; if the soil be rich it will produce five, six, or more shoots, one of which is to be made the leader; and if not quite erect it must be made so by fastening it to a stake, and as soon as the leading shoot is ten or eleven inches long, stop it by pinching off its end. If it pushes forth again two or more shoots, pinch all off but from one to three leaves, leaving the topmost for a leader. The side shoots in general assume a regular form; should they not do so stake them into it, taking care not to have them too close. They may thus remain until the end of August or the beginning of September, when they may be shortened to eight, ten or more buds, as may be found necessary to the formation of the tree. The second year the tree will make strong vigorous growth; the side shoots that were stopped last fall will push out three, four or more shoots. In June, or as soon as they have made four or five leaves, pinch them off to three leaves, leaving the leading shoots of the side branches unpinched, to extract the superabundant sap till the end of August. As fruit trees differ in their habits—some varieties making strong vigorous shoots, others, under precisely the same treatment, weak and slender—this must be noticed in the final shortening in August, those that are vigorous must not be cut so short as those that are less so. The fact is, every variety requires some little modification, more or less, which experience alone can teach. Year after year continue on in this manner, taking care to keep your trees in a proper form, open and free for the circulation of air. Be careful in dressing back spurs, and in renewing branches where necessary. The apple, plum, cherry, &c., may all be treated in a similar manner for pyramids.

"The bush tree, so called, is well adapted for all situations, if the climate be good. It is very suitable for elevated, exposed places, if not much subjected to high winds. Some varieties of the pear, the apple, and other fruits are naturally inclined to be bushy and dwarfish; some of the other fruits are likewise so. The horizontal and crooked-growing sorts are the best for this purpose, and can very easily be brought into shape. The bush tree may be grown from four to six, ten, or twelve feet high, and of a proportionable breadth. The bush tree is treated similar to the pyramid in pinching and pruning, but with a difference in training; in this case no leaders are required, all the branches are naturally drawn out, pinched regularly, equally branched, but not crossed in any way. With the bush as with the pyramid, sufficient openness must be kept in view.

"All orchard owners would find it much to their advantage to keep their orchards clean, their trees free of dead wood and useless saplings; very little time need be spent in doing this, if judiciously gone about. Early in spring take a sharp draw-hoe or some like instrument, scrape and clean the trunks or stems and limbs of all the moss and dried bark, then wash them over with a thin solution of soft soap, destroy all root-suckers and mulch over the roots regularly. A little attention in this way will be amply rewarded at the proper season by boughs laden with blossoms, and, in due time, the luscious fruit."