Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, SEPTEMBER 15, 1883.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 402,

For the Week ending September 15, 1883.

Price 10 cents. For sale by all newsdealers.

PETROLEUM FOR LIGHT.

Two revolutions may fairly be considered to be the results of the introduction of petroleum as an agent in the advance of modern civilization. One of these is yet, to a certain extent in the future, undeveloped for the present, and we may study it by and by. The other is of daily experience; its import is indicated by the title above given.

A bright light in the home is so absolutely and intimately associated with cheerfulness and domestic enjoyment and with the higher grade of social life which is the sure attendant of all intellectual advancement, that it becomes a difficult thing to overestimate the value of that which places such a light within the reach of those whose pecuniary resources are small. Of the wealthy we need not speak, but for the greater proportion of every community the means of brilliant illumination at small expense does more for health, for preservation of life, for happiness, for morality, for social elevation, than words can express. If the degree of civilization of a nation can be estimated by the condition of its roads, more truly is it shown by the light in its dwellings. Dimness, degradation, and depravity are not merely an alliteration.

And here is where petroleum has a mighty claim to our respect, and where, as stated, it has caused a revolution, and this revolution is one of our own day. Why have New Bedford, Nantucket, New London, and Sag Harbor ceased to have the importance which they formerly held? Forty years ago, when their whale ships arrived from the Indian Ocean, the Northwest, or the Arctic, their casks represented in their contents of whale oil or sperm oil a certain amount of light or lubrication, which was absolutely necessary for the comfort and the progress of communities. Those same casks would represent exactly the same amount of light and lubrication now, but with a totally different relation to the world's requirements. The dim tallow candle, with the plain tin lamp whose two round wicks, crusted and smoked with whale oil, was superseded by the better lamp of glass, burning a better oil—sperm—and giving a brighter light, and then came camphene and the burning fluids, brighter still, to be followed up by coal oil, so called because it was distilled from soft or bituminous coal. And then, when it was found that this same substance could be produced much more cheaply in another way, coal oil died, while, phœnix-like, kerosene lived in its stead, and still lives and bids fair to live and reign indefinitely.

Of the nature and origin of petroleum we may speak at another time, calling attention here only to the fact that it is the complete analogue in a liquid form of coal as a solid, particularly bituminous coal, which it closely resembles. It is called a hydrocarbon, meaning a combination of hydrogen and carbon. It is, however, a coupled series of hydrocarbons blended in one, and, what seems very singular to one not conversant with chemical working, these various hydrocarbons can be separated perfectly, simply by careful management of heat.

When crude petroleum, in a retort, is subjected to a very gentle heat, light vapors pass off which are exceedingly and dangerously inflammable and can be condensed to liquid form only with much difficulty. Cymogene first, and then rhigolene are formed, but have scarcely been turned to account as yet, except that rhigolene has been employed as a local anæsthetic, by means of its almost instantaneous evaporation. But when the liquid from the retort has reached a specific gravity of 95° B., it can be made available. The pipe is then transferred to another tank, the heat is increased, and the distillation is continued until the escaping liquid stands at 65°. The average gravity in this tank is about 80°; the liquid is crude naphtha.

The heat is still further raised, the pipe goes to another tank, and continues till the gravity becomes 38°, and the color becomes somewhat yellowish. This is the universally known *kerosene*, and its specific gravity should be 51° to 55°.

But this is not the way in which kerosene was first made. This name was given to it by Abram Gesner of Prince Edward's Island in 1846, though the name was not generally adopted for a long time, and it came into very common use as *coal oil*, for it is obtained very readily by distilling any of the bituminous coals, and was made in large quantities by James Young of Glasgow as early as 1850, using Boghead cannel coal or Torbanehill mineral.

The first factory in this country was established in 1854, on Newtown Creek, near what is now the well known and notorious Hunter's Point, on Long Island, opposite New York. The work still continues actively there, new factories having been added, and the odors which they have steadily poured forth have been nauseous beyond description. We well know the efforts which have been made to abate the nuisance.

As the production was very profitable, works were erected in great numbers, all along the coal regions of Kentucky, Ohio, Virginia, etc., as well as on the coast. In 1860 the amount of coal oil yielded by the coast distilleries alone was 200,000 barrels. But while these works were thus in the full tide of success they were suddenly brought to the very verge of ruin. Petroleum had begun to pour upon the market in enormous quantities, and it was found that kerosene, identical with the coal oil, could be distilled from it much more cheaply than from the coal. The fright was extreme, but it was of short duration, for the ingenuity of the distillers proved itself competent to meet the difficulty. They modified their apparatus with but small expense, so as to use the new material instead of the old; the name *coal oil* was speedily dropped, and in its place *kerosene* became a household word.

From the statements here made it is easy to see that the desire for gain may readily lead unprincipled men to risk the lives of their fellow beings most fearfully. If a distiller of petroleum will but turn the pipe from his retort into the kerosene tank a very few degrees before the liquid has reached the proper point, say 68° to 70°, he greatly increases the yield and the profit. Kerosene is what he wishes to sell, and he has now in his tank, of what he calls kerosene, a much larger quantity than should be there, simply because it has received so many gallons that ought to have gone into the naphtha tank. Such a liquid will burn of course, and it has the odor of kerosene, but it is most fearfully explosive. Gunpowder may be handled in the midst of matches, lighted cigars, etc., etc., with far greater safety. The great frequency of horrible accidents is due mainly to this cause. The use of kerosene of proper specific gravity is free from danger, with any average degree of carefulness. Whether any legislative enactments will ever cure the evil, so long as men are selfish and reckless, seems doubtful. But even with this risk the advantages of kerosene as an illuminator are so many that it will hold its ground.

We are in receipt of a note from "a subscriber," signing himself W. M. L., who incloses a slip cut from the Philadelphia *Ledger* of August 23, on "The Recent Lamp Explosion." He asks for explanation. The paper states that, as they understand, "the flame was driven down into the lamp (which was a very strong one) by the movements of Mrs. Muller. . . . The oil itself is said to have been of good quality," and the inference is therefore that the unfortunate Mrs. Muller owed her death to gross carelessness on her own part. It may be that this is true, but there is no proof of it.

If the oil had been what it professed to be—*kerosene*—there is little doubt that she might be at this moment in life and health, and if it were possible some one ought to be held responsible for her death, that one being the manufacturer, who to increase the contents of this kerosene tank turned the discharge pipe from his retort into it while the gravity was too low, say 70° or perhaps even a greater figure still, and thus put into the market the dangerous mixture of naphtha and kerosene which Mrs. Muller's lamp contained, and whose like is so constantly bought by those whose necessities or whose parsimony causes them to use cheap kerosene.

It is worth while to repeat here, "the use of kerosene of proper specific gravity is free from danger with any average degree of carefulness." The explosions of lamps do not occur from its employment. The lamps themselves are seldom to blame, but it should be enforced upon the minds and attention of the community, by every means in our power, that it is fully as safe to handle a rattlesnake, or to fool with a bottle of nitroglycerine, as to burn kerosene containing much of the lighter oil. One may escape death in either case, but he does not deserve any such good fortune.

We have no disposition to assert that kerosene of the most perfect quality may not explode, and cause fearful havoc. When Bridget begins to pour it on the coals to make them burn quicker, there is quite a possibility that she may stop pouring of a sudden, and the kerosene not be culpable. We saw a young man pour powder that way once from his flask, thinking he could close the spring when it began to flash. He was not quick enough, but it was very good powder.

EXPORTS OF MANUFACTURES.

Although the present foreign demand for an article of American manufacture may not amount to one per cent of the home consumption, it is well known that most of our manufacturers make their lowest prices for such export trade. No one belittles the importance of our great yearly exports of grain, cotton, and provisions, but a keener and more personal interest is at once manifested when any increase of shipments of manufactured goods can be noted. The foreign markets for our agricultural products depends largely upon the more or less favoring seasons, here and abroad, but these have nothing to do with shaping the keen competition under which our mills and workshops, our capitalists and mechanics, are reaching out to obtain a larger portion of the world's trade in manufactured articles. It is especially gratifying, therefore, to find, from recent reports of the Bureau of Statistics, that while the total exports for the last fiscal year are valued at more than seventy million dollars in excess of those for the preceding twelve months, a large part of this increase is made up of manufactures.

At the Millers' Convention in Cincinnati, two years ago, it was urged by many in that trade from abroad that, unless English and Continental millers modified their processes and improved their mills, American millers would in the future give them a closer competition than ever before. Well, the exports of wheat flour the last fiscal year, to July, 1883, amounted to 9,205,664 barrels, valued at $54,824,459, against 5,915,686 barrels, valued at $36,375,055, for the preceding twelve months. These figures show that the foreign millers who came over at that time to investigate the state of their industry here had most excellent grounds for their apprehensions.

In iron and steel and their manufactures the exports do not show a large increase, but that there is a positive growth, with a large diminution in our imports in this line, is at once a source of gratification to the home and disappointment to the foreign trade. With the recent great activity in railroad building it had been expected that we would be more free buyers abroad, but the imports of the last year only figure for $40,796,007, against $51,377,633 the year preceding, while our exports advanced from $17,551,322 to $19,165,321 during the same period. This, it will be remembered, is our largest industry (next to agriculture), and great as are England's advantages, we think it no overconfidence to expect a steady increase in the exports, especially in stationary and locomotive engines, boilers, car wheels, edge tools, fire-arms, and general machinery, in all of which there has been a healthy growth in our foreign trade the past year.

The percentage of imported to home manufactures consumed, taking the figures of the last census for the latter, shows in a most gratifying way how small comparatively many of our imports are when considered in connection with the great and varied demands of our people. In agricultural implements, while producing to the value of nearly seventy million dollars, we imported nothing, and exported last year $3,940,509, an increase of about one million on the preceding twelve months. In beer, ale, and porter, with production over a hundred million dollars, imports were only 0·74 of one per cent. In carriages, carts, etc., while producing $76,971,137, the imports were 0·12 of one per cent, with exports last year of $1,607,502. In railroad cars we import nothing, but last year exported $1,900,903. In cotton manufactures and mixed textiles we imported 8·78 per cent of our consumption, exporting not quite half as much. In jewelry, etc., with manufactures of $33,896,910, the imports were only 0·85 of one per cent, and the exports of last year were $422,854. In leather we are still considerable purchasers of fine calf and kid skins, and with a total production exceeding two hundred million dollars in value, imported 3·62 per cent of our consumption, exporting about an equal value in heavy sole leather. In paper and stationery, while manufacturing to the value of $180,179,380, we used 0·99 of one per cent of foreign, and our exports last year were $1,589,908. In plated ware, printing presses and types, scales and balances, and a thousand lesser articles, we imported nothing, although there is hardly an article in the list of which we do not export to some extent.

In the whole outlook of our business, as affected by imports and exports, there is but one point on which the eye can rest with serious dissatisfaction, and that is in remembering that nearly all of our carrying trade with foreign ports, both imports and exports, is done by vessels built and owned abroad. We sold last year to foreigners only $169,-209 in both steam and sailing vessels, or only about one tenth the value of an ordinary Atlantic liner, so that our shipbuilders can only find employment in working for the coasting trade or in an occasional government contract. With a fair proportion of the ocean carrying trade in American hands we should undoubtedly experience a great augmentation of our exports of manufactures, and be able to compete with foreign producers on far better terms in the markets of South America, Australia, on the Indian Ocean, and elsewhere.

ECONOMY OF STEAM.

The suggestion was recently made that power might be economized in the use of steam engines by employing the steam, not as the direct motive force in driving whatever machinery was involved, but rather by causing it to expend its energy in forcing air into a suitable reservoir, this compressed air cylinder furnishing then the active agent for propulsion. The object at that time was that wind wheels might come in as coadjutors to the steam engine, by yielding their own quota to the stock of compressed air, and thus saving precisely so much of steam power, which means of course *fuel*.

But if this method of using steam could be brought into practical service, economy could be secured in a totally different direction, to which our attention is called by the title above given.

Whenever, and wherever, a steam engine is at work, it must be kept at its full working head of steam, nearly up to the very close of its service. Just before a steamer reaches her wharf, or before the six o'clock bell is about to ring for the shutting down of mill or factory work, if the engineer has a surplus of power, he can afford to bank his fires, and economize a trifle by working down a few pounds of his extra steam. But it is only a very little, for he must of course retain enough to drive the engine at its working gait fully up to the last minute. And when the bell rings and he shuts off steam for the end of the trip or the close of the day's work, his gauge shows a pressure but a few pounds below that at which he regularly runs. His boiler therefore is now a reservoir of power which is practically to be wasted. He either "blows off steam," or he does not, according to circumstances, but in either event the greater proportion of that power is lost for service. The dissipation of heat which necessarily takes place before the hour comes for starting again measures precisely the amount of energy wasted, for the vapor of water owes its efficacy only to the heat of recent importation. Without the heat its elasticity is gone. Can we not possibly substitute for it a gas whose elasticity does not depend on recent heat, but is a permanent quality at all temperatures, notwithstanding the fact that an increase of temperature gives an augmented elastic force?

Compressed air furnishes us exactly what we need to answer our purpose. Were the force of the steam used mediately, through an air tank, and not directly, it would be an extremely simple matter to utilize the heat remaining in the boiler, furnaces, etc., so that scarcely any portion of it should be wasted. One turn of a switch would connect the steam power at once with pumps which would go on forcing air into the air tank so long as any power remained. No attention would be needed. When the power was expended the engine would stop moving, and all would remain quiet till required for use. The air thus condensed would be a given amount of active energy ready for application on call, and the efficient service of the engine for the next day would have just that amount furnished to its credit, with no expense added; that degree of expense would be saved. How much this would actually economize must depend on the circumstances, but it would in any case be no insignificant item. Inquiries made of steamboat engineers show that in their judgment it would be sufficient to run the boat from five miles to ten, according to her size and speed. Some go much higher than that. And with a large ocean steamer there can be scarcely a doubt that it would decidedly exceed this. Surely this is a wasted power, which is worth saving. A.

Fog Signals.

Connected with the Light-house Service is the system of warnings by "fog signals," which comes in use in what the sailors call "thick weather;" that is, when mist or fog prevents the lights and landmarks from being seen either by night or by day.

The principal fog signals used in this country are the siren, the steam-trumpet, the steam-whistle, the whistling buoy, the bell-boat, the bell-buoy, and heavy bells rung by clock-work. The siren is sounded by driving steam through a flat, circular disk, containing a number of slits, the disk being fixed in the throat of an immense trumpet. Behind this is a revolving plate, having in it a similar number of openings. The plate is revolved by steam 2,400 times each minute. Whenever the slits in the plate coincide with those in the disk a jet of steam escapes through each opening, under great pressure, into the trumpet. If there are 10 openings, there will be 24,000 screams each minute. These combined in the trumpet give a single, strong shriek in deafening volume and of great range. The sound can generally be heard at a distance of 20 miles, and can readily be distinguished from all noises at sea. The siren is the furthest reaching fog signal yet produced, but it is the most expensive to build, the most difficult to run, and the most costly to keep going. One of these machines was on exhibition at the Centennial Exposition in 1876, where it made such a nuisance of itself that it was restricted from sounding except at the opening and closing hours, and then it was heard all over Philadelphia. One of the largest size sirens is connected with the light-house at Cape Henlopen, at the mouth of Delaware Bay, opposite Cape May, where in fog it gives a blast 6 seconds long after an interval of 39 seconds. These instruments have done so well on our coasts that other countries have procured numbers of them. Great Britain has more than twenty of them now in operation on her shores.

The Daboll fog trumpet is made like a monster clarinet, and is sounded by air condensed in a reservoir by machinery driven by a hot-air engine. The largest trumpet is 17 feet long, with a mouth 38 inches across and a throat 3½ inches in diameter. Its reed of steel is 10 inches long, 2½ wide, an inch thick at its fixed end and half that at the other. The Ericsson engine that drives it has a 32-inch cylinder, which, at 20 pounds pressure, can give a five-second blast every minute. The Daboll trumpet is, however, going out of favor because of its liability to accident and the difficulty of getting it repaired. The nearest one to us is in Long Island Sound, at Execution Rocks Light Station.

The most frequently used fog signal of this general class is the locomotive steam whistle, with a diameter varying from 6 to 18 inches, operated by an ordinary boiler, under a pressure varying from 50 to 100 pounds. By intervals of blast and silence it can be differentiated from neighboring fog signals, and these intervals automatically produced by having an engine take steam from the same boiler and open and close its valves at fixed times, when the steam is shut off or let on as desired. These instruments do not easily get out of order and they are readily operated. The whistles are used on light-ships as well as at light-houses. There is a 12-inch whistle on each of the light-ships on Five Fathom Bank, off the Capes of the Delaware.

The power of these fog signals can be expressed in proportion thus: siren, 9; whistle, 7; trumpet, 4; and as to cost of running them they stand as follows: siren, 9; whistle, 3; and trumpet, 1. There are 66 fog signals now on our coasts operated by steam or hot air.

The bell-boat, which is at best a clumsy contrivance, liable to be upset when most needed, costly to build, hard to handle, and difficult to keep in repair, has been superseded by Brown's bell-buoy, which was invented by an officer of the Light-house Service. The bell is mounted on the bottom section of an iron buoy, which is decked over and fitted with a frame-work of 3 inch angle iron, 9 feet high, to which a 300 pound bell is rigidly attached. A concentric grooved iron plate is made fast to the frame under the bell and close to it, and a cannon ball is allowed to roll on this plate. As the buoy rolls on the sea the ball rolls on the plate, striking one side of the bell at each roll. The signal is always at work, and the heavier the sea the louder the sound of the bell. There are 24 of these bells now in use in this country, one of which is on Brown Shoal, Delaware Bay. They cost, with their mooring, not far from $1,000 each.

The "whistling buoy" consists of an iron pear-shaped ball, say 22 feet in diameter, with a tube 20 inches across and 40 feet long running through it. The water in the tube acts as a piston to draw in the air through a hole covered with a retaining valve, and to expel it through a 10-inch whistle, making a shrill moaning sound, which can be heard several miles. Its dimensions have recently been reduced, without decreasing its power. As its action depends on rough water, it is only used in open water. They now cost, with their moorings, about $1,200 each. There are 25 of them on our coasts, 5 of which are in our immediate waters. The whistling buoy recently placed on the outer Hatteras shoal, just off the pitch of the Cape, is of the greatest use to our coasters.

The bell fog signal most in use is the bell struck by machinery and moved by clock work. There are about 120 of these bells. They weigh from 300 to 3,000 pounds each, though not many weigh more than 1,000 pounds.—*Phil. Ledger.*

PASSAGE OF THE NEW BRITISH PATENT LAW.

After prolonged discussion and many amendments the new patent bill for Great Britain has passed both houses of Parliament, has received the royal assent, and will come into force January 1, 1884. We have not yet received the full text of the law, but we are advised by our London correspondent that among its principal features are the following:

A material reduction has been made in the cost of applications for patents, which we roughly calculate will not exceed $100 for the complete patent, including both agency and government fees for the provisional and final specifications. It is difficult, of course, to say, definitely, what the incidental expenses will be until we can by practical experience ascertain exactly the amount of work involved by reason of the various objections and requirements which may be made by the examiners in each particular case, but we think that the amount named will cover all expenses.

Another feature is the extension of provisional protection to nine months, also to substitution of annual taxes in lieu of the £50 and £100 stamp duties now charged, the same total amount being, however, payable; but the first annual tax not being payable until the fourth year after the grant of the patent. These provisions also apply to patents now in course of application, and also to patents already granted on which the £50 and £100 taxes fall due after January 1st next.

In view of the changes it will readily be perceived that the new act will give a great impetus to the taking out of patents in Great Britain, for it may be fairly calculated that a proportion of the patents taken out in the United States and in other countries will also be secured in England.

It is not proposed, under the new law, to follow the system of examination as in the United States and Germany, but to adhere to the practice hitherto prevailing in England; that is to say, to issue the patent to the applicant without examination, at his own risk. It is, nevertheless, proposed to create a body of examiners whose principal duties will be to see that the invention described and claimed in the final specification is the same as that described in the provisional, and that the scope of the patent is strictly limited to a single invention.

This is an excellent provision, and ought to be adopted in our law. Our present system of official examination is, practically, a hinderance and an annoyance to the inventor, not a benefit. It delays the issue of his patent, and in many cases involves him in expensive and harrassing interference contests, which after all decide nothing, as the courts are obliged to review the Patent Office work and determine the validity of the patent. The United States, Canada, and Germany are now almost the only countries that pretend officially to examine. In other countries the patent is always granted, and the inventor examines for himself. If he chooses to pay the fees he may take out a patent, but if it should afterward appear that the invention was lacking in novelty or utility, then the patent is worthless. This is a straightforward system, and works well in all countries where it is in vogue; its adoption here would be a decided improvement in favor of inventors; it would lighten the duties of our Patent Office examiners, and enable them to do better work in respect to those necessary features of examination which the new English law contemplates.

Another important provision of the new English law is that power is taken to conclude international arrangements, so that the publication in England of the foreign specification for a period of six months shall not invalidate a patent applied for during that period; furthermore, the duration of the patent will always be fourteen years, notwithstanding the lapsing of a previous foreign patent of a shorter term.

DR. H. F. HAMILTON says that at least once a day girls should have their halters taken off, the bars let down, and be turned loose like young colts. "Calisthenics may be very genteel, and romping very ungenteel, but one is the shadow, the other the substance, of healthful exercise."