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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 158,

For the Week ending November 30, 1878.

Price 10 cents. For sale by all newsdealers.

THE UTILIZATION OF PETROLEUM.

In an article on the outlook in the petroleum region, a late number of the *Petroleum Reporter* says: "When we see Europe so stocked and filled with the product that the values have gone below any point heretofore reached within the history of the trade, and when, in addition to this, we see a greater activity in the producing region than has ever before been known to continue and enlarge the over-production, it is little less than absurd to hope for any result except bankruptcy to the producer."

With home and foreign markets filled to repletion; with an increasing production both here and abroad; with the price lower than it has been for sixteen years ($1.06 per barrel, or about 2½ cents per gallon, delivered free on board), and a stock on hand in the producing region of nearly five million barrels, the prospects of the producers are so gloomy that it is with but little surprise that we learn that the proposition to decrease the amount held, in the hope of enhancing the value of that left, by emptying most of it into the river or burning it up, has been seriously advocated by some of them. Such a plan, however, would serve to stimulate increased production, and defeat the desired object.

A remedy for these conditions cannot be found in a day; they will doubtless continue for a long time.

The producers and holders of petroleum have for years been too much occupied in getting and accumulating, and have given too little attention to the possible ways of disposing of it. New applications, new uses for the product, are imperatively necessary to restore a healthy tone to this industry. Some plan must be discovered by which the consumption shall be made to keep more even pace with the production.

Already we are witnessing the beginning of a great change in the manufacture of illuminating gas, which, though in its infancy, and opposed at every step by watchful and persistent coal gas monopolies, will eventually afford a broad outlet for this oil. The consumption of three gallons or thereabouts of petroleum per one thousand feet of gas by the new processes, whose success has been fully demonstrated in Baltimore, Philadelphia, and many other places, is a matter, we should think, of sufficient importance to assure the co-operation of the oil producers in extending the benefits of the processes and defending them against the present gas monopolies.

But it is especially in the application of petroleum as fuel to metallurgic and other purposes that sufficient and permanent relief can best be secured, and it is a matter of great surprise that the oil producers have paid so little attention, have been so indifferent, to the results obtained and progress made in the use of this fuel in metallurgy, and to the accumulating evidence of the accuracy of the predictions of Rankine, Prideaux, Sainte-Claire Deville, Wurtz, and scores of other able investigators concerning it.

Of late years, in repeated instances of continuous working, the actual efficiency of petroleum in firing boilers has been shown to be from two to three times greater than that of the best solid coal, weight for weight, and in puddling and heating furnaces from four to six times greater, while in steel melting furnaces its superiority is still more manifest, its thermal effects being more decided the higher the temperature required.

Besides, it is conclusively shown by a mass of testimony that, by reason of the purity and intensity of its flame, petroleum, in iron working, removes the contaminating sulphur and phosphorus more thoroughly even than the Siemens gas process.

These advantages, then, which petroleum possesses over coal, must inevitably draw its producers and the iron manufacturers into closer relationship, where they will be mutually dependent and of mutual benefit to each other. But as iron manufacturers are at all times conservative and especially opposed, in the present condition of trade, to any change that may involve present expense, the initiative must be taken by the other party. The oil producers must exert a pressure by themselves building iron works, and demonstrate in open competition that they can manufacture and sell a better and cheaper iron than can in any other way be produced.

A petroleum furnace, to work successfully, should be so constructed as to secure intimate mixture of the gases, complete combustion in the body of the furnace, and a supply and pressure of the incandescent steam, air, and oil adjustable to the varying working conditions.

Above all others thus far brought to our notice the Eames furnace seems to possess these requisites in a superior degree; the shape of the body of the furnace differs but little from the ordinary iron furnace, but in place of the fire place and ash pit are a vapor generator, a superheater, a mixing chamber, and a combustion chamber, while in close proximity, as a very important part of the apparatus, is a small force pump. The superheater is a double casting, inclosing the fire, so chambered that the steam which enters it is brought in contact with ample heating surface before passing into the vapor generator, about 150 pounds of coal per diem being used in this.

The vapor generator is a cast iron vessel of about 18x30 inches internal dimensions, placed over the superheater, and containing a number of shelves or plates set one above another, projecting alternately from opposite sides. Next in order is the mixing chamber, where the steam and oil vapors are mingled with the proper amount of air; and beyond this, occupying the place of the usual bridge wall, is the combustion chamber, which is an indispensable part of the apparatus, though it consists simply of a cellular tier of fire bricks placed on end and having a horizontal thickness of 18 inches Within these cells the combustion begins.

From a tank placed in any convenient position the pump draws the petroleum, and forces it, at about 10 lbs. pressure, into the vapor generator in a very slender stream, where it flows downward in a thin layer, dropping from shelf to shelf. It thus meets the opposing current of superheated steam which passes upward from the superheater; thence the combined vapors or gases pass through a pipe to the mixing chamber to receive the required amount of air, and from this into the cellular combustion chamber, where begins the combustion which is completed in the furnace itself.

The experience of all users of petroleum fuel has shown that the superheating the steam, vaporizing the oil, and the mixture with air must, in order to insure complete combustion, be done before they reach the furnace; and we consider the Eames arrangement to be admirably adapted to that end.

For the purpose of guaranteeing absolute safety in the use of this fuel, the pump is fitted with what is called an equalizing valve, which absolutely regulates the flow of the oil into the generator, and, at the same time, interposes an insurmountable obstacle between the generator and oil tank to any chance reaction of gases or flame. Pressure gauges on the oil feed pipe and on the generator serve to give further security in the manipulation of the apparatus.

Success in this direction rests upon clearly defined general principles, which, in this instance, are well understood and applied; and the result offers to oil producers an extensive use for their product, and to the iron manufacturers the way to make better and cheaper iron.

A TRADE MARK DECISION.

During the four years in which the United States trade mark law has been in force, the question of its constitutionality has not been raised in the courts until quite recently. In the case of Leidersdorff & Co., tobacconists, to enjoin Flint & Co. from the use of certain labels, the defendants demurred, and held that the court had no jurisdiction. In his decision, November 12, Judge Dyer, of the United States Court, Milwaukee, Wis., sustained the demurrer, deciding that the constitutionality of the trade mark statute cannot be sustained under the clause which gives to Congress the power to regulate commerce among the several States, nor under any other of the provisions of the Constitution prescribing the legislative power of Congress.

In case this decision is sustained by the Supreme Court, the owners of invaded trade mark rights will have to fall back upon the State courts for their defense. The actual protection against commercial piracy will be no whit lessened; yet the convenience of a national law on this point is so great, that an amendment of the United States Constitution providing for such issues would be quite justifiable, should that instrument prove to contain no provision now for such a law. The experience of all industrial nations has proved the need of some such national means for protecting trade marks. It has also become a matter of international comity; and as an industrial nation the United States cannot afford to lag behind in the protection of those who have earned an honorable and profitable reputation for their manufactures.

THE WASTAGE OF CARBON IN ELECTRIC LAMPS.

One source of failure in electric lighting by the incandescence of carbon in a vacuum, or in an atmosphere furnishing no recognized supporter of combustion, has been the gradual wasting of the carbon, due to volatilization according to received explanations.

The electrical inventor of the Sawyer-Man lamp says that this explanation is erroneous; there can be no volatilization under the circumstances, since the carbon is not fused. The wastage is due, he says, entirely to a process of decomposition and recomposition, the smallest trace of any substance capable of uniting with the carbon at the high temperature of the electric light sufficing with time to destroy the incandescent carbon. Thus in a lamp globe charged with carbonic CO or CO_2, the gas is decomposed, the carbon deposited on the cooler glass, and the oxygen left free to attack the carbon; and this "circular" process goes on so long as the light is kept up, the minutest trace of oxygen sufficing to destroy any mass of carbon.

In the course of extended experiments Messrs. Sawyer & Man claim to have positively ascertained that sulphur and phosphorus are equally as destructive of the carbon burner as oxygen; that chlorine is fatal to it, and hydrogen; and that any compound gas whatever, even in the smallest quantities, is sure destruction to carbon under such conditions. The only gases that will not combine with carbon are pure carbon and pure nitrogen, singly or together. The Sawyer-Man lamp is filled chiefly, Mr. Sawyer says, with pure nitrogen. Yet there is also a portion of pure carbon gas. The secret of the preparation he does not reveal.

VENTILATION OF VESSELS.

Medical Inspector, Thomas J. Turner, U. S. Navy, a member of the board appointed to consider and report a plan for the better ventilation of the vessels of the navy, has reported in favor of a modified form of the Napier system. Next to securing a larger supply of pure air, Mr. Turner insists on drier air. The unwholesomeness of the air of the berth decks is increased by its excessive humidity,

which has its origin almost entirely in the daily water soaking routine which exists in the service. He says:

"If this routine washing, holystoning, wiping, clamping, scrubbing, etc., is meant for cleanliness, an obvious inference therefrom would disrate the Augean stables from their billets as the pre-eminent examples of filth, and our vessels would be promoted to that unenvied rating."

The berth decks should be kept dry, and the seamen supplied with wholesome air; in this way two of the most potent of disease producing agencies of ship life will be removed.

THE LARGEST CASH VAULT IN THE WORLD.

The new bullion vault for the Sub-treasury, corner of Nassau street and Wall street, New York, is said to be the largest of its kind in the world. It is situated in the west basement, immediately under the coin room, with which it is connected by an iron stairway and an iron elevator, worked by hydraulic pressure.

The vault is surrounded by a granite wall seven feet thick, with an inner wall, roof and floor of iron and steel, between two and three inches thick. It is entered by two stout iron doors, each of which has two combination locks; the outer door being also guarded by a chronometer lock. The unlocking of either of the combination locks opens the door, two being used to prevent the trouble liable to occur through the derangement of a single lock. The vault is 48 feet long by 28 feet wide and 12 feet high; and is divided into several compartments by iron railings. It cost about $25,000.

INCREASING TRADE WITH CHILI.

Through the efforts of Postal Commissioner Fralick, the attention of the merchants of Chili has been called to the vast manufacturing resources of this country, and an encouraging impulse has thereby been given to this department of our export trade. According to the Philadelphia *Record*, a member of a large Valparaiso firm having a branch house at Hamburg, Germany, was induced by Mr. Fralick to visit Philadelphia, where, after an inspection of a large number of industrial establishments, orders were left for nearly $100,000 worth of goods. November 18, the first installment of these orders was carried out by a Swedish bark, whose manifest showed, among other goods, 104 cases galvanized and corrugated iron, 3,341 bars and 204 bundles bar iron, 834 kegs nails, 309 bars cast steel, 14 cases saws, 2 cases hardware and tools, and 68 dozen shovels. She also has on board, 4 bales drygoods, 1,000 gallons refined oil, 330 tons bituminous coal, 12 gross chains, 100,000 feet of lumber, 12 gross hats, 100 dozen mining sledges, 125 dozen brushes, and 22 cases Vienna bread.

AMERICAN CONTRIBUTIONS TO MODERN ARTILLERY.

In a very timely article on the weakness of the United States in the matter of heavy artillery, the *Army and Navy Gazette* remarks that although miserably armed, we have the skill to make the best guns, and our citizens have contributed the leading principles of gun construction on which all modern European systems are based. In proof of this position the journal discusses at considerable length the advantages of the American system of rifling, Rodman's pressure gauge for gunpowder and the influence it has had on powder making and gun construction, the advantages of expanding projectiles, and the chambered gun, all of which have been appropriated by European nations; and then goes on to say: "It is rather startling to see the skill of one nation so deftly appropriated by others, and the first nation neither keeping the skill within its own territory nor apparently caring to keep pace with modern progress. There need be no foreign military attachés at Washington, because our inventors seem to get away as fast as possible and sell everything valuable to foreign governments."

If the United States do not take steps to put our coast cities in a proper condition of defense, the *Journal* insists we shall not only remain as we now are, unwarrantably exposed to attack, but in a little while everything that we have invented will come back to us with a foreign name.

"Our mammoth powder will become 'pebble,' and perforated cake be known as 'prismatic;' our pressure gauge as a 'crusher gauge,' and the Hotchkiss case shot be credited to Colonel Boxer. Professor Treadwell's system of gun construction, of 1840, is known as Armstrong's, of 1856, but no one has seen Armstrong's patent for it. Krupp has appropriated the Broadwell system bodily, and Eastman's slotted screw breech plug is known as the French breech loading gun. The Russian government built a great foundry at Perm to carry out Rodman's designs on a large scale, and took his powder and his experience along. Mr. S. B. Dean invented a method of mandreling bronze guns by which strength and hardness are greatly increased, and two years after his patents were taken in Austria, his gun was brought there as the Uchatius gun and a vast achievement. Their whole artillery is armed with it. Mr. Parsons has shown how the strongest guns may be made with steel tubes and cast iron exteriors. Mr. Hotchkiss has gone to France and established a large factory near Paris, where he has very extensive orders, and has become, in his line, the main reliance of the French government."

THE FUSING OF CARBON.

The carbons of the Sawyer-Man Lamp present several peculiar features, notably a bright gray metallic luster, and extreme hardness. The inventors found existing carbons to be insufficiently homogeneous, and liable to disintegration by heat; so they devised the new form, but do not disclose the method of its preparation. These carbons whiten with protracted use, and also increase in hardness; they appear to have been originally formed at a temperature approaching fusion.

Before proper means for regulating the current to the lamps were devised it was no infrequent thing for a lamp to come to grief through an excess of electricity. In such cases the carbon pencil would soften and double up by its own weight. In a note with reference to such accidents Mr. Sawyer writes us as follows: "Professor Barker, of the University of Pennsylvania, assured me that I was the first to have fused carbon. If this is so, I can assure you that nothing is easier. If the carbon pencil cannot chemically combine with the atmosphere contained in the globe of our lamp, when too much current is given it, it must either burst or fuse; and it never bursts." Whether the fused carbon could be made to crystallize as diamond, Mr. Sawyer does not pretend to say; one thing, however, is certain, a diamond so formed would cost all it was worth.

ALUM IN BAKING POWDERS.

To the Editor of the Scientific American:

Prof. Henry A. Mott, Jr., in your issue of November 16, has favored the readers of the SCIENTIFIC AMERICAN with an interesting article on the above subject.

The large and widespread use of baking powders as substitutes for yeast in various kinds of cookery renders this question one of interest and importance to every one.

As a matter of fact, however, your former correspondent has put the subject in a more formidable shape, and has given your readers a greater "scare" than the actual facts of the case will warrant; and as the question is one that is sure to excite more or less discussion in your columns, a little chemistry on the subject here may not be amiss.

No one will deny for an instant that alum by itself has a powerful effect upon the membranes of the human system. If he has any doubt on the subject, let him taste a minute particle. Even when taken in the smallest quantities—so small that it cannot be tasted in the bread—it may be more or less injurious, especially when taken successively for a continued period, as would be the case with the daily customer of any baker using it. The behavior in this way of mere traces of various salts upon the system is well illustrated in the case of drinking waters, as almost every one has experienced in the change of water involved in traveling, visiting summer resorts, etc.

The presence of alum in bread, therefore, cannot but be open to objection.

The presence of alum in baking powders is a question altogether different; a point which seems to be overlooked in nearly all articles on this subject.

The second active ingredient in baking powders is bicarbonate of soda, generally present in quantities equal in weight to the alum present (as shown by Professor Mott's analyses).

Alum being a salt with an "acid reaction" (to speak technically), acts on the soda in the same way that a free acid would. Both the soda and alum are completely and entirely destroyed as such, the results of the reaction being:

1. Carbonic acid gas; the agent that causes the bread to "rise."
2. Sulphate of soda.
3. Precipitated and insoluble alumina.

None of these three have any more resemblance to alum, in their appearance or behavior, than they have to quinine, sugar, or common salt.

One might as well suppose that because caustic soda (better known as "concentrated lye") is a powerful and strong alkali, therefore soap, which is made largely from it, would be a dangerous article to have about on our washstands. Or that because muriatic acid is a very disagreeable and corrosive acid, therefore common salt (which can be made from it and the above caustic soda) should be banished from our salt cellars.

But we have not yet reached the root of this matter. The question still to be settled is: Have these three resulting compounds in the bread any action upon the system, and if so, of what nature is their action?

As already stated, the results of the reaction are (1) carbonic acic, (2) alumina, and (3) sulphate of soda.

The first is, of course, the same as the carbonic acid from yeast, or from any baking powder.

The alumina is a white, gelatinous, insoluble substance, which is scarcely, if at all, dissolved by the weaker acids, especially after having been heated, and would, therefore, most probably pass through the system, unaffected by the juices of the stomach, as a simple inert substance. The total amount present is about one-tenth of one per cent. of the weight of the bread.

The sulphate of soda has precisely the same action upon the system that the Rochelle salt resulting from the cream of tartar-baking powder has. With this exception, that the former is somewhat stronger in its action, both belonging to the class of bodies known as "purgatives." *

So that it may be truthfully and conscientiously stated that whatever effect a "cream of tartar" baking power may have upon the system, an "alum" baking powder will likewise have, only in a somewhat higher degree; and that alum in bread, and sulphate of soda in biscuits, are two utterly and entirely different questions.

* See United States Dispensatory. The small percentage of sulphate of potash, or of ammonia, present (according to whether the alum used is potash or ammonia alum), will not alter the result. The potash salt is also a mild purgative. The action of the ammonia sulphate is not given.

It is frequently the case that many inventions and new articles of commerce, although possessing much intrinsic value, have to come in contact with popular prejudice or a sort of "orthodox" scientific opposition, resulting from a mistaken or partial view of the question.

Such was the case with artificial butter, and also with the much discussed "carbonic oxide" in water gas. It appears to me that the subject of this article is a chip of the same block.

It seems hardly a compliment to the common sense of our American manufacturers, that they should be credited with putting forth an article used almost daily in many households, that has properties so virulent and effects so injurious as the "popular" view of this subject would lead us to suppose it possesses. Yours, etc.,

Phila., Pa., Nov. 9, 1878. HENRY PEMBERTON, JR.

[In the article referred to by Mr. Pemberton—an article, we may add, evidently written by Dr. Mott in the interest of the Royal Baking Powder Company—the writer was clearly at fault. Finding alum in the baking powders named, Dr. Mott leads the reader to infer that there must be alum in the biscuits made therewith. This inference, as Mr. Pemberton shows beyond a doubt, is altogether wrong; the chemical process of baking causing the total disappearance of the alum as such, the resulting compounds being either wholesome or inert. The certificate of Professor Doremus, given below, shows that biscuits made with the Dooley Baking Powder, and presumably also with other powders of the same kind, contain neither alum nor any other deleterious substance. Moreover, the manufacturers of Dooley's Baking Powder inform us that the alleged analysis of their powder, given by Dr. Mott, does not correctly represent the composition of that article.

Those who know the gentlemen in question will not need to be told that they would not be guilty of making and selling for public consumption an article either adulterated or injurious. The whole matter, indeed, seems, on examination, to resolve itself into a rivalry between different methods of producing baking powders; and in lauding one form, at the expense of another equally wholesome, Dr. Mott, we fear, lays his communication justly open to the criticism in the letter of our Colorado correspondent printed herewith. —EDS. SCI. AM.]

Dr. Doremus' Opinion of the Dooley Baking Powders.

BELLEVUE HOSPITAL MEDICAL COLLEGE,
New York, November 15, 1878.

This is to certify that I purchased of Mr. S. H. Williamson, 26 Broadway, a can of "Dooley's Baking Powder;" that I had biscuits made therewith; that I have analyzed the same; and that they do not contain alum, or any other deleterious substance. R. OGDEN DOREMUS, M.D., LL.D.,

Professor of Chemistry and Toxicology in the Bellevue Hospital Medical College.

Alum in Baking Powders.

To the Editor of the Scientific American:

In your issue of November 16, Henry A. Mott, Jr., professedly for the benefit of the "dear public," gives an analysis of four different makes of baking powders, and recommends the use of only one (the Royal), whereas he claims to have analyzed forty-two different kinds, 50 per cent of which he says contain deleterious substances. Now, why, if Mr. Mott is so zealous for the public good, could he not have given the whole forty-two analyses and left out a little of his elucidations? It would have taken up very little more space in your columns, and would have looked less like an advertisement of the Royal Baking Powder.

Now, I do not doubt that the analyses given are correct, otherwise he would not have dared to publish them, but in justice to all manufacturers and the true good of the public, let us have the full list. PRO BONO PUBLICO

Boulder, Col., Nov. 14, 1878.

A Golden Meteorite.

The Yuma (Cal.) *Sentinel* describes as a "meteorite" a specimen lately picked up in the Mohave desert and brought to Fort Yuma. According to the *Sentinel*, "it weighs about a pound, and carries free gold, of which nearly a dollar appears on the surface. It is not magnetic, and has successfully resisted simple and compound baths of acid. In this respect it resembles specular iron, but in no other. One of its surfaces shows a fracture that reveals a crystalline structure, the color of which is a steel gray, tinged with yellow. It has defied the best cold chisels in the blacksmith shop, and has not broken or chipped under heavy blows. If its composition can be imitated it will produce the hardest and toughest alloy known."

Utilizing Old Rails.

A new use for old rails is being put to practical test at the workshops of the Prince Edward's Island Railway Company. The plan of the bridge is a lattice girder, 31 feet span. The top chord is formed of three rails laid parallel; the bottom chord is formed in like manner, the lower rails being placed in an inverted position. The diagonal bracing is formed of short pieces of rails, bent at the upper and lower ends, and twisted with a half turn in the middle, so as to cause the flanges to come in conjunction with the flanges of the top and bottom chords. The flanges are then riveted together with ⅜ inch rivets. At each place where the braces and counters meet the chord a ½ inch iron plate is introduced, which binds the three rails of the chord together. The rails used are 40 lb. iron of the Sandberg pattern.