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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 262,

For the Week ending January 8, 1881.

Price 10 cents. For sale by all newsdealers.

THE ELECTRIC LIGHTS ON BROADWAY, NEW YORK.

In our issue dated December 25 mention was made of preparations going on for the experimental lighting of a section of Broadway with electric lamps. The promises of the company making the test—the Brush Electric Light Company, of New York—were fulfilled somewhat ahead of the time fixed, and on the night of December 19 the twelve blocks between 14th and 26th streets, including a portion of Madison square, were lighted by sixteen lamps on a single circuit. Although there were already in use in this city, in private establishments, something like a hundred Brush lamps, this was the first application of them to street lighting here, and the experiment naturally attracted much attention. The company proposes to continue the exhibition of the lamps for a month or more, keeping a careful record of the several elements of cost, so that an authoritative decision can be arrived at touching the economy of the system and its ability to take the place of gas in the lighting of our streets. That the electric light is very much cheaper than gas, quantity for quantity, is already abundantly demonstrated and pretty generally recognized; the question to be determined now is whether the vastly brighter illumination demanded when electricity is used, and is really needed for the satisfactory lighting of our streets, can be had at a price which the public is willing to pay.

The difference in the degree of illumination obtained under the two systems is far greater than is popularly supposed. In the section of Broadway lighted by electricity there are sixteen lamps—each of 2,000 candle power—each having at least twice the illuminating power of all the gas lights hitherto used there. Anywhere in the electrically illuminated district it is possible to read type of the size used in the SCIENTIFIC AMERICAN, and the light is purer and more steady than any gas light. Yet the popular impression at first was that the electric light was a trifle dim, and that the lamps should have been placed nearer together.

The company making this experiment was organized under the laws of this State some time last fall, its field of operation being limited to Manhattan Island. As already noted, the Brush system of lighting had been adopted in quite a number of our larger mercantile establishments, and many other merchants and manufacturers favored its introduction, but did not require lamps enough to warrant the purchase of separate generating machines. The success of the system elsewhere made it probable that it would be as favorably received here, and that its general use might be extended not only to the larger shops, warehouses, factories, etc., but also to the public streets and parks. Accordingly the New York company was organized to develop the field. The district selected for the first central station includes a large number of prominent hotels, club houses, theaters, and other places of amusement, and covers what has become the chief shopping district of the city. Seeing the favorable issue of the first street experiment, it is safe to infer that the future progress of the electric light in this city will not be slow. At this writing the wires have been set up as far as 34th street, and it is expected that the company will be officially invited at an early day to submit a bid for the lighting of the square mile of territory around the central station.

Ample preparations are making at the preliminary station for the extension of the system. Already half of a double Corliss engine of 200 horse power has been set up, with three dynamo machines, each capable of sustaining sixteen lamps of 2,000 candle power. Foundations are being prepared for half a dozen more machines of the same size, and one 40-light machine. With the latter type of machine the power required is four-fifths of a horse power to each lamp; with the smaller machines it is a little more, though it is estimated that the completed engine will be able to supply 250 lamps of 2,000 candle power each.

The lamps are of simple construction, very plain in appearance, relatively inexpensive and easy to keep in order. The street lamps are provided with two sets of carbons, each good for eight hours' burning, and so adjusted that when one set is exhausted the current shifts to the other. No clockwork is employed in feeding the carbons, their movement being effected by a simple automatic electric arrangement, which secures a constant adjustment and a remarkably steady light.

It is evident that the contest between gas and electricity for the lighting of our streets has now passed from the theoretical to the practical stage. It is tolerably clear, too, that popular sympathy has a decided leaning toward electricity. It is to be hoped that on the score of cost the tests will result as favorably as they have in respect to the quality of the light.

GROOVE TRACK PAVEMENT.

In his much repeated lecture on "Lost Arts," Mr. Wendell Phillips describes an ancient roadway—Assyrian, if we recollect aright—which was made of stone blocks grooved for the wheels of wagons.

Something similar would seem to be proposed by the Groove Track Pavement Company, of this city, which has applied for permission to place in lower Broadway and the streets leading therefrom to the ferries a complete equipment of five sets of tracks, with three tracks in each set to suit the gauge of every kind of vehicle. The petitioners also ask the privilege of constructing an experimental set of tracks in Union square, as "an entering wedge" toward laying in every street in the city such tracks as would permit the use of compressed air as a motor for all sorts of vehicles. Whether these tracks are to be accounted public highways does not appear, though if they are not it is obvious that the public would not long be left with any usable portion of their own streets, should the petition be granted. The petitioners further ask for the privilege of running light and convenient vehicles for carrying passengers and baggage, at a speed not exceeding 20 minutes from Union square to either of the ferries; vehicles to be run at intervals of two minutes; and the fare to be 5 cents, to include the carrying of 50 pounds of personal baggage. The fare, they say further, is to be prorated with all connecting omnibus and horse railroad lines that desire this arrangement, and excluding and prohibiting all other vehicles from carrying passengers, except such as now run in Broadway. In consideration for this decidedly valuable grant, the Groove Track Pavement Company proposed to keep the streets in which their tracks were laid well paved, tracked, and cleaned from dirt or snow, and to pay into the City Treasury one cent for every full fare collected, this amount to be allowed to taxpayers occupying the property bounding the said streets by a corresponding reduction of their taxes.

The scheme is put forth ostensibly for the relief of the blocked and crowded condition of Broadway. It is clear that it would put an end to blockades—by driving off the street all vehicles not owned or licensed by the Pavement Company. The business firms along Broadway would doubtless prefer an occasional "block."

AN UNWISE PHYSICIAN.

There have been no nobler instances of self-sacrifice than those recorded of physicians who, to save a patient or to investigate a disease, have taken extreme risks at the cost of their lives. There is, however, a reasonable limit to such experiments, and no physician is warranted in subjecting himself to needless hazards. If the object aimed at can be gained without incurring any special risk it is obviously the part of wisdom to choose the safer way. The spirit which impelled young Dr. Sanford to choose the more dangerous way, and so lose his life, at Greenpoint the other day, was beyond question commendable; but his act was the reverse of justifiable.

As the case is reported, Dr. Sanford had been attending a child afflicted with malignant diphtheria, watching the patient day and night. At last the air passages became blocked, and the doctor resorted to the use of the knife. He made an opening in the windpipe, inserted a small rubber tube, and with his mouth drew out the poisonous fluid. By this act he prolonged the child's life several hours, but put an end to his own life.

This is not the first fatal instance of the sort which has occurred in this country, and two or three cases of the same nature have been reported in France. The infectious character of the diphtheritic excretion is well known, and Dr. Sanford knew that his life would possibly, if not probably, pay the forfeit for his professional zeal.

Ought he to have taken the risk? More specifically: can we justify his taking the risk?

We have no hesitation in answering, "Certainly not!"

For the simple reason that the deadly matter could have been as promptly and as surely drawn off by purely mechanical means. The emergency was not a sudden one, or one that could not have been provided for beforehand. In any apothecary shop the doctor might have bought for a few cents a rubber bulb that would have served the purpose of an aspirator as well as his own mouth, and it would not have suffered infection from the poisonous matter drawn into it.

Our natural admiration for devotion carried to the point of self-sacrifice is apt to make us forget to ask whether the devotion might not better have been manifested in a more rational and equally effective way. In Dr. Sanford's case we think it might.

INTERNATIONAL EXCHANGE OF FOOD FISH.

While the German carp is being domesticated among us, converting our shallow fishless ponds into reservoirs of wholesome food, several useful fish of this country are being introduced into German waters. Recently 250,000 eggs of the delicious white fish of our great lakes were shipped by the U. S. Fish Commission to the German Fisheries Association, of Berlin. The eggs came from the United States hatcheries at Northville, Mich. The 700,000 eggs of the California salmon, shipped to Germany, France, Holland, and England some months ago, all arrived in good condition. Brook trout have also been sent to Germany, where they can scarcely fail to thrive. Germany has sent us the carp, in return, and also the golden ide, a beautiful and promising fish, which is under cultivation in the ponds of the Maryland Fish Commission.

It is expected that the Berlin Association will send, in addition to the species which have already been received from them, eggs of the saibling or charr, the large and handsome trout peculiar to the deep lakes of Northern Europe. It is highly esteemed as a food fish, and in Lake Constance it sometimes attains the weight of twenty-five pounds.

TEMPORARY DEAFNESS.

According to Dr. H. Augustus Wilson, a very common cause of deafness is the hardening of wax in the ear and the unscientific plan that people adopt for its removal. They generally succeed in making a bad matter worse. The ear is not so exquisitively sensitive to the presence of foreign matter as the eye, and hence those who work at the ear with hairpins and toothpicks are likely to injure themselves irreparably. Only the softest materials and the gentlest pressure should be used in cleaning the ear. In a recent clinical lecture, the full report of which we give in the SCIENTIFIC AMERICAN SUPPLEMENT, Dr. Wilson gives, in popular form, some very useful and practical information touching the removal of ear-wax. If the ticking of a watch can be heard at a distance of 28 inches the hearing is good. Each ear should be tested by the watch separately. Noises in the head, sometimes ringing, frequently are due to hardened wax in the ear. Sudden deafness is sometimes caused as follows: A small mass of wax, from ill-health or uncleanliness, becomes hard. A continued secretion of wax then blocks up the ear tube still more. An injudicious attempt is then made to remove the wax by introducing, perhaps, a match end, a pin head, or a pen holder, which instead of removing pushes down the wax and packs it against the tympanum; or by a sudden draught or the act of swallowing the wax is suddenly pressed upon the membrane, and loss of hearing immediately ensues, because the membrane can no longer vibrate. The removal of the wax is in some cases, especially those of long standing, somewhat difficult; but with gentle treatment and patience may finally be accomplished and the hearing fully restored. The best ordinary means for removing wax, when not badly compacted, are half a drachm of sodium carbonate dissolved in an ounce of water, applied lightly, by means of a bit of absorbent cotton or sponge attached to a suitable handle. When the wax is much compacted it may be softened by means of water, quite warm, and a syringe.

A Remarkable Boiler Explosion.

The first explosion of a stationary boiler in this city, for a period of five or six years, occurred about midnight, December 17, under decidedly peculiar circumstances.

It was a new vertical tubular boiler, which had been tested within a year to 150 pounds, and was registered at 100 pounds. It was set upon a fire box of quarter inch iron, in a newly constructed brick boiler house, in the rear of No. 123 West Twenty-sixth street.

The engineer claims that when he left the boiler that evening the water was within a few inches of the top of the boiler, the fire was dying out, and, as he intended to build a fresh fire in the morning, he opened the furnace door and closed the damper and ash pan. Wood for kindling the next day's fire was in the boiler house. On going away he fastened the outer gate with a chain and padlock.

About midnight the neighborhood was startled by an explosion, and when an examination was made, the boiler-house was found to be wrecked and the boiler gone. Two hours later it was discovered in the rear of No. 441 Sixth Avenue, something like 200 feet from where it belonged. It was unbroken, and had fallen on end after its long flight over a number of tall buildings.

As the gate which the engineer locked was found to have been tampered with, and the kindling wood was missing, it was suspected that some one had taken refuge in the boiler house, or entered it maliciously, and had fired up, leaving the furnace doors closed on going away. The two steam gauges, which fell through a skylight two blocks away, registered 70 and 80 pounds respectively.

Coal Oil in Italy.

A Naples correspondent writes to a contemporary: "It is a noteworthy fact that mineral oil similar to that of Pennsylvania has lately been pumped in the Valley Cocco, in the Abruzzi, and also at Riva-Nazzano, near Voghera, in Piedmont, and it is believed that after a few more months' digging the oil springs themselves will be found. The American mode of extracting the oil is used, and some expert Canadians are employed on the work by an Italo-French company formed at Paris. The pumps are worked by steam, and the whistle of the engine is now heard where not long ago the shepherd's pipe was the only sound that broke the silence of the valley. As long ago as 1866 some Italians were ready to seek for petroleum in these localities, but were forced to desist from want of means. An illustrious geologist has asserted that there are many valleys in Italy rich in this oil, and several specimens of native petroleum exist in the geological cabinet of the museum at Milan. Companies are being formed to prosecute this industry, which must prove very profitable, for there is a tax of 50 per cent on the American oil, and expenses of transport equal to 20 per cent. If the Italians themselves do not enter into the speculation, it is certain that strangers will not be long in doing so."

Francis T. Buckland, well known in this country and in Europe as a writer on natural history, died at his home in London on December 19, 1880, at the age of 54. He was the eldest son of the Rev. William Buckland, D.D., Dean of Westminster. He was a student of Christ Church, Oxford, where he took his B.A. degree in 1848. He inherited a strong taste for natural history and physical science, and devoted himself to the study of medicine, and in 1854 became assistant surgeon to the 2d Light Guards, retiring in 1863. He was a voluminous contributor of papers on pisciculture and physical science to the London *Times* and our excellent contemporary *Land and Water*. At his own expense he established the "Museum of Economic Fish culture" at the Royal Horticultural Gardens, and did other things for which he was publicly thanked by the Royal College of Surgeons.

THE EXPANSION OF STEAM.

BY PROF. R. H. THURSTON.

In studying the actual performance of steam engines we have seen, as was stated in the reply to the question, "What is the proper point of cut-off in steam engines to give maximum economy in dollars and cents?" that the best point of cut-off is determined by so many and such variable conditions that we can only ascertain what is the best rate of expansion by experience with each class of engine.

The experiments made many years ago by the Navy Department on various kinds of marine sidewheel engines working at moderate speed and having unjacketed cylinders, the steam pressure being 25 to 30 pounds by gauge, proved the point of cut-off giving maximum economy to be at from four-tenths to five-tenths,* and such engines are still so worked.

With the higher piston speed customary with screw engines a little greater expansion may be attained. The irregularity of wheel which is due to short cut-off is one of the retarding elements which exists in less degree in the latter case though a serious drawback in the former, so serious that many engineers would hesitate to expand more than $2\frac{1}{2}$ times even with steam at 30 to 40 pounds where the engine is of long stroke like our river beam engines.

In the case of the ordinary unjacketed stationary engine with drop cut-off and a speed of about 300 times the cube root of stroke measured in feet, the best examples that I have known have expanded about 3 times, neglecting clearance, when steam was carried at 40 or 50 pounds, as was common at their first introduction, 4 times when carrying steam at 60 to 70, and about 5 times with 100 pounds of steam. For such cases I should therefore be inclined to proportion engines, when designing them, to cut-off at about $\frac{1}{2}\sqrt{P}$.

With engines of *very* high piston speed, with engines of high speed and steam jacketed, and with compound engines in which the expansion is so divided as to reduce losses by internal condensation and to make the frictional resistances less, I should make the design such as would assume an expansion of about $\frac{3}{4}\sqrt{P}$. Thus the Porter-Allen engine, the pioneer of high speed engines, may, it is said, work with maximum economy at a cut-off of about one-eighth when steam is carried at 100 pounds per gauge. Yet an engineer of great experience, Mr. D. K. Clark, puts the point of maximum economy for the single cylinder jacketed engine with steam at 55 pounds at but one-fourth, the expansion ratio for the unjacketed engine with steam at 75 being put at 3.

The best figures for compound engines are about these:

Elder & Co.'s compound marine engine, with steam at 55 to 60, expanding $3\frac{1}{2}$ times, and giving a horse power for a little less than $1\frac{3}{4}$ pounds coal per hour. (Donkin's stationary engines: steam, 50 to 55, coal, about 2 pounds expansion, $13\frac{1}{2}$ times, and Leavitt's pumping engine: steam, 90; expansion, $13\frac{1}{2}$ times; consuming 18 pounds steam—illustrate successful practice with greater expansion.)

United States steamer Bache (Emery's design); steam, 90 pounds; expansion, 7 times; using $20\frac{1}{3}$ pounds steam (or feed water) per horse power and per hour; and steamer Rush (same designer); steam, $82\frac{1}{3}$; expanding $6\frac{1}{4}$ times; using $18\frac{1}{2}$ pounds steam per horse power and per hour, are good cases.

In the latter case the designer concludes that it is of little advantage to carry steam pressure much above 100 pounds, and puts the economical points of cut-off at or more than one-fifth stroke for 80 pounds, and two-sevenths to one-quarter for the lower pressures used, and gives as a fair working rule for number of expansions $\frac{P \times 37}{22}$ for good single engines. He thinks this too high for ordinary engines and too low for compound, conclusions that it will be well to compare with my own.

Other such figures might be given, but these show that the best point of cut-off for engines constructed by the best builders is only known by actual experience, and is far within that which would give a terminal pressure equal to the back pressure line of the indicator diagram. Ignorance of this fact has caused the loss of many hundreds of thousands of dollars by builders and users of steam engines, who have vainly striven to secure economy of fuel by extreme expansion; and the loss due to too great expansion is usually greater than that caused by too little.

With increased piston speed and velocity of rotation, with increased efficiency of steam jackets and with increased dryness of steam, such as is obtained by superheating, we get nearer and nearer the ideal conditions of expansion, and no one can say where we may reach a final practical limit. We only know that progress is very slow in that direction, and we are still *very* far from the ideal limit.

My own conclusion is, therefore, as already stated, that engines, as they are built to-day by the best builders for marine or for mill work, with unjacketed cylinders and moderate piston speed, do their best work when expanding about one-half the square root of the steam pressure. Were I to choose the style of engine I should select the "compound" condensing engine for all work demanding very regular or very slow speed, and where a double engine has its special advantages, as in pumping or on shipboard; I would superheat moderately, steam jacket carefully—heads even more carefully than sides—and expand $\frac{3}{4}\sqrt{P}$ to $\sqrt{P}$, the latter at high speeds and with thin inserted cylinder barrel.

Where I could be confident of good work, and where a single engine might be allowable on other grounds, as in mills, I should probably select a high speed engine, steam jacket it completely, superheat 50° to 75° Fah., and expand $\frac{3}{4}\sqrt{P}$, using a condenser, where water could be had, whenever the engine was of moderate or large size.

Where compelled by limited means, or where the exceptionally low cost of fuel or other circumstances make it best to use the unjacketed cylinder and the less expensive forms of engine with drop cut-off, I would expand as in the first case above, $\frac{1}{2}\sqrt{P}$. And finally, if using the plain old-fashioned slide valve, I would set it to cut-off by the lap at three-fourths and raise the link in regular work so as to cut-off at about four-tenths or five-tenths, cushioning heavily and running fast. With that valve gear the limit is fixed, without reference to pressure, by the construction. High piston speed is of advantage in all cases where it can be adopted. Where the steam jacket becomes comparatively inefficient, as at very high rates of expansion, the remedy would be to design engines with thinner cylinders and heads, trusting to ribs for strength, and I should be inclined to use the inserted cylinder, as have some of the British makers for many years past.

The use of wrought iron or of brass cylinder linings properly secured would permit more rapid transfer of heat, and would in some cases, I have no doubt, prove of advantage. Non-conducting linings, as used by Smeaton and later by Emery could they be made to stand, would perhaps be still better.

As engines are actually built, every intelligent builder, if possessed of sufficient experience, knows pretty nearly what is the best point of cut-off for his engines, and is himself the best authority on that subject. The degree with which that point approximates to that found for a theoretically perfect set of conditions is also a true gauge of the value of his engine and all engines might be graded by this comparison. It is, perhaps, the best method of determining the economical value of any given *type* of engine under any given set of conditions.

* Clearance neglected.

Lecture Experiments.

COMBINING AND ILLUSTRATING THE GLOWING OF PLATINUM IN A CURRENT OF ILLUMINATING GAS WITH THE RENDERING LUMINOUS OF A BUNSEN BURNER FLAME, WHEN THE GAS IS PREVIOUSLY HEATED.

An ordinary Bunsen burner is increased in length to the extent of, say, 3 or 4 inches, by adapting a platinum tube to the upper end, of such a caliber as to snugly fit. On placing the latter in a horizontal position, and opening the cock, the ordinary flame is first obtained; thereupon, with another burner, the platinum tube is heated to bright redness, the non-luminous flame now becomes the ordinary luminous one. The change is most marked when the cock is not more than half open. Now remove the second burner and place the first upright; the platinum then begins to glow at the upper edge, which glowing soon passes down and extends nearly throughout its entire length. On closing the cock and opening, after incandescence has entirely ceased, it will again glow as before; this time, however, without flame at its extremity. C. GILBERT WHEELER.

Laboratory of the University of Chicago.

Propelling Boats Without Wheels or Screw.

Attempt has been made to propel boats on canals and rivers by conducting a column of water through a pipe and ejecting it forcibly at the stern, but it did not prove successful.

An Englishman now claims to have got over the difficulty by showing that "the force exerted by one fluid pouring into or against another depends on the contact of surfaces, and not on the sectional area of the flowing mass, after the flowing mass be once set in motion." Instead, therefore, of tubes with large orifice, he makes use of tubes with narrow outlet, a mere slit, and thus obtains a large superficial contact by ejecting water through a series of narrow openings.

New York to Philadelphia in One Hour.

The distance between New York and Philadelphia, in an air line, is 81 miles, over a comparatively level country. In a recent paper before the Franklin Institute, Mr. W. Barnet Le Van maintained that an air line road could be constructed between the two cities, on which trains could make the distance in one hour, and that the enterprise would pay. The line he proposed would cross no roads at grade, and would have but two curves of 10,000 feet radius each.

FOR articles of rubber which have become hard and brittle, Dr. Pol recommends the following treatment: Immerse the articles in a mixture of water of ammonia one part, and water two parts, for a time varying from a few minutes to an hour, according to the circumstances of the case. When the mixture has acted enough on the rubber it will be found to have recovered all its elasticity, smoothness, and softness.

CHIAN TURPENTINE IN CANCER.—At a recent meeting of the Medical Committee of the Middlesex Hospital, London, it was resolved that no more Chian turpentine should be ordered for the treatment of cancer, as, after a prolonged and careful trial, it had been found that its results were perfectly negative.—*Lancet.*