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NEW YORK, SATURDAY, JANUARY 7, 1882.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 814,

For the Week ending January 7, 1882.

Price 10 cents. For sale by all newsdealers.

NEW LAWS FOR ANALYZING FOOD AND DRUGS.

There is a probability of increased interest during the next few years in methods of testing the genuineness of all articles of food, beverages, and medicines. Several of the States have lately passed laws authorizing official analysis of these articles wherever they are upon sale. Comprehensive laws of this kind have been passed within a year or two in Wisconsin and New York. And several States have lately enacted official inspection of particular articles; for example, Indiana required analysis of all fertilizers in market and of all the oils into which petroleum enters; Maine, of vinegar; Massachusetts, Nevada, and New Jersey, of milk; Ohio, of milk, butter, cheese, and meat, and of fertilizers.

Anything like censorship of ordinary dealings has generally been unpopular in America, and indeed, in recent years, in England. English laws of three or four centuries ago were stringent in punishing adulterations, but these laws were in great part repealed, and for a long time trade was left free, it being supposed that the seller would find his own interest promoted by selling a good article, and that the buyer would be able to judge of what he bought, and reject it if not according to contract. And such laws as have been passed under the pressure of increasing necessity for protecting the public against adulteration, have, until very lately, avoided everything like censorship of trade, being confined to imposing damages or punishment for any fraud committed, provided the buyer could prove it. They gave him no help in advance. The purchaser bought coffee, sugar, or milk, as he found it on sale in the stores. He carried the article home as it was delivered to him. If there he found the milk watered, the sugar sanded, or the coffee composed in large part of burnt beans or something worse, he could complain, but in proving his complaint he was dependent on such evidence as he could himself command; his own testimony or that of his servants, perhaps, who first opened and used the article. In 1860, and again in 1875, Parliament passed laws for England intended to give purchasers the aid of a system of inspection. The leading features of the system are that inspectors and public analysts are appointed in various localities, and an inspector, or the town or city officers, or even an individual purchaser, may visit a suspected dealer, demand to buy a sample of his goods, carry the sample to the public analyst, and obtain an official examination. The report of the analyst that he finds adulteration becomes evidence, perhaps not conclusive, of the dealer's guilt. This principle of giving the general public the benefit of a system of scientific examination of whatever articles mentioned in the law are upon sale in the shops and markets, is just now winning adoption in this country. If the new laws are vigorously enforced attention will be drawn to all simple, trustworthy modes of detecting these commercial frauds.

The New York law was passed May 28, 1881, but was not to go into operation until the fall. To understand its method the reader must recall that in 1880 the legislature created a State Board of Health. There were, previously, local boards of health in particular cities. These are not abolished, but the State Board is clothed with power to work throughout the entire State in collecting and arranging information on the public health and mortality, supervising registration of births, marriages, and deaths, enforcing various sanitary laws, investigating alleged nuisances, and the like. By the new law to prevent adulterations this State Board of Health is authorized to "take cognizance of the interests of the public health as it relates to the sale of food and drugs and the adulteration of the same, and make all necessary investigations and inquiries relating thereto." The board is directed to prepare rules and regulations with regard to the proper methods of collecting and examining articles and for the appointment of inspectors and analysts, and may remove either of those officers who may be deemed incompetent. The rules and regulations are to be published in the book of statutes from year to year. The law includes every article used for food or drink by man, and all medicines for internal or external use, except mixtures or compounds recognized as ordinary articles of food not injurious to health, and distinctly labeled as mixtures, and except specific articles which the Board of Health, with the approval of the Governor, may declare to be exempted from the law. Every dealer is required by the law to serve or supply any public analyst or other agent of the State, or a local board of health who may apply and tender the value of the same, with a sample sufficient for analysis of any article of food or drugs in his possession. A penalty of fifty or one hundred dollars for a first or any subsequent refusal to sell a sample is imposed.

The scheme of the law is that these samples may be examined by the public analyst and his report may be used as a basis of bringing the dealer under punishment, and there is a distinct provision imposing a fine of fifty or one hundred dollars for a first or any subsequent offense of manufacturing or keeping for sale any article of food or drugs which is adulterated. It will not be necessary under the law to prove a sale, for knowingly keeping the adulterated goods in stock is enough. The law seems defective in not saying how the report of the analyst shall be used to secure the conviction of a dishonest dealer. This want may perhaps be supplied by a regulation to be adopted by the Board of Health, though the courts may probably hold that the dealer has the right to be "confronted with the witnesses against him;" in other words, that the analyst must, if required, appear in court and relate, under oath, the facts of the examination made by him.

The definition of adulteration given in the law is drawn with more care than are other portions; it well deserves scrutiny of experts in this field. It is as follows:

An article shall be deemed to be adulterated within the meaning of this act.

A.—In the case of drugs

1. If, when sold under or by a name recognized in the United States Pharmacopœia, it differs from the standard of strength, quality, or purity laid down in such work.

2. If, when sold under or by a name not recognized in the United States Pharmacopœia, but which is found in some other pharmacopœia or other standard work on materia medica, it differs materially from the standard of strength, quality, or purity laid down in such work.

3. If its strength or purity fall below the professed standard under which it is sold.

B.—In the case of food or drink.

1. If any substance or substances has or have been mixed with it so as to reduce or lower or injuriously affect its quality or strength.

2. If any inferior or cheaper substance or substances have been substituted wholly or in part for the article.

3. If any valuable constituent of the article has been wholly or in part abstracted.

4. If it be an imitation of or be sold under the name of another article.

5. If it consists wholly or in part of a diseased or decomposed, or putrid or rotten, animal or vegetable substance, whether manufactured or not, or in the case of milk, if it is the produce of a diseased animal.

6. If it be colored, or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value.

ENGLISH AS THE SPEECH OF THE FUTURE.

The success of the English-speaking peoples as colonists and their superior prolificness are not the only reasons for thinking that the English tongue is destined to dominate the world. The flexibility and terseness of the English language has made it the language of international telegraphy, and from statistics just collected it appears to be the great newspaper language. In other words, it about equally divides the newspapers of the world with all other tongues combined.

The total number of newspapers and periodicals now published is given in H. P. Hubbard's forthcoming "Newspaper and Bank Directory of the World," as 34,274, with a circulation of about 116,000,000 copies, the annual aggregate circulation reaching, in round numbers, 10,600,000,000 copies. Europe leads with 19,557, and North America follows with 12,400, the two together making over nine-tenths of all the publications in existence. Asia has 775; South America, 699; Australasia, 661; and Africa, 132. Of all these, 16,500 are printed in the English language, 7,800 in German, 3,850 in French, and over 1,600 in Spanish. There are 4,020 daily newspapers, 18,274 tri-weeklies and weeklies, and 8,508 issued less frequently. It appears that while the annual aggregate circulation of publications in the United States is 2,600,000,000, that of Great Britain and Ireland is 2,260,000,000.

THE LOSS OF THE JEANNETTE.

In the loss of the Jeannette another vessel has been added to the list of sacrifices to Arctic exploration. Fortunately the commander of the expedition, Lieutenant De Long, and nearly all of the other officers and crew, have been saved, and strong hopes are entertained with regard to the safety of the rest. Before the Jeannette sailed from San Francisco, July 8, 1879, Commander De Long announced his intention to retreat upon the Siberian settlements in case of disaster to his vessel. The disaster came, and the retreat has been effected with as great success as could have been expected under the circumstances.

On the 19th of December, 1881, the Governor of Eastern Siberia telegraphed that three months before two boat loads from the wrecked Jeannette had reached a remote part of the Siberian coast, near the mouth of the Lena; and the announcement was quickly followed by a dispatch from Engineer Melville, as follows:

"IRKUTSK, Dec. 21, 2:05 P.M.

"Jeannette was crushed by the ice in latitude 77 deg. 15 min. north, longitude 157 deg. east. Boats and sleds made a good retreat to fifty miles northwest of the Lena River, where the three boats were separated in a gale. The whaleboat, in charge of Chief Engineer Melville, entered the east mouth of the Lena River on September 17. It was stopped by ice in the river. We found a native village, and as soon as the river closed I put myself in communication with the Commandant at Boloemga. On October 29 I heard that the first cutter, containing Lieutenant De Long, Dr. Ambler, and twelve others, had landed at the north mouth of the Lena. The Commandant at Boloemga sent instant relief to the whaleboat party, who are well. Nindeman and Noras arrived at Boloemga on October 29 for relief for the first cutter, all of whom are in a sad condition and in danger of starvation, and all badly frozen. The Commandant at Boloemga has sent native scouts to look for them, and will urge vigorous and constant search until they are found. The second cutter has not yet been heard from."

The Jeannette was last seen September 3, 1879, steaming northward toward what is now known as Wrangell Island. The course since then is unknown, save that it must have been westward for about a thousand miles. The place of the disaster was about five hundred geographical miles northeast of the mouths of the Lena, the nearest known land, the New Siberian Islands, being about a hundred and fifty miles away.

THE Arizona, of the Guion Line, during the past summer, made five trips between New York and Liverpool, *via* Queenstown, averaging 7 days 12 hours and 4 minutes for each trip between New York and Queenstown. The Elbe, of the Bremen Line, has made the passage westwards in 7 days 10 hours and 25 minutes.

The Recent Boiler Explosion at the Dayton Wheel Works.

To the Editor of the Scientific American:

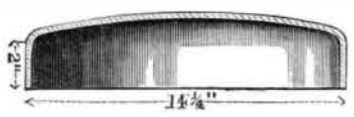
We have carefully read the article in your issue of SCIENTIFIC AMERICAN, December 17, 1881, on the "Boiler Explosion at Dayton Wheel Works," October 25th last.

You are right: boiler explosions *should not* be put down to mysterious causes, such as "*Electricity*," etc., and with the hope that we may still get to the *reason why* good iron becomes *brittle*, we venture to ask a few questions:

Would good iron (say C. H. No. 1, 55,000 T. S.) become brittle if thickly incrusted on the inside with hard lime scale such as steam users have to contend with in this Miami Valley (the water from wells passing through a limestone bed), and would not such incrustation particularly affect the longitudinal seams on the sides exposed to fire?

And would not the hinge-bending motion referred to as caused by variations of pressure on the flattened portion of the boiler at the double-riveted seam be intensified somewhat by the quick motion cut-off of an engine (no disparagement to engine meant), which *did cause* a variation of pressure of three pounds of steam, as indicated by steam gauges at every stroke of the piston?

Now, Mr. Editor, we have in our office a boiler head of flanged iron, cut from a point as near as possible to the supposed initial fracture on boiler shell—dimensions, 14¼ inches diameter; flange turned on same 2 inches deep, as shown by sketch—*and there is not a flaw or crack in it anywhere.* This head was turned by hand in the presence of the committee. They also bent portions of this iron cold in different ways, and pronounced the material to be good.



We are as anxious as any one else to demonstrate that steam boilers explode from a cause or causes, and trust that this article may be the means of calling forth the experience of others.

E. H. BROWNELL & Co.,
Per JOHN T. CAULFIELD, Supt.

Dayton, O., December, 1881.

Remarks.—Nothing has so far appeared from the investigations of the disaster that reflects adversely upon the workmanship or good faith of Messrs. Brownell, the makers of the boiler in question. Their reputation for thoroughly good work and good materials is widely known. But in the present state of the art of iron plate manufacturing there is risk that both the seller and the purchaser may be deceived, since carelessness on the part of puddlers, or the presence of a lump of deleterious matter in the ball, may produce a bad spot in the rolled plate, which does not show to the eye, and which might readily escape the notice of the boiler maker.

There is need for a simple and easy means of detecting the presence of bad places or poverty in the quality of finished boiler plates; and the inventor who succeeds in studying it out will deserve well of the public.

Steel plates, owing to their greater general strength and the greater purification of the material in the process of manufacture, are safer and therefore better adapted for boilers than iron plates.

To the question, "Would good iron (say C. H. No. 1. 55,000 T. S.), become brittle if thickly incrusted on the inside with hard lime scale, such as steam users have to contend with in the Miami Valley (the water from wells passing through limestone beds)?" the answer is, Yes.

"And would not such incrustation particularly affect the longitudinal seams on the sides exposed to the fire?" Answer, Yes. Lime scale has no chemical effect on the iron tending to change its internal structure as some people appear to think. It is rather than otherwise a protector against corrosion of the surfaces which it covers, and in a boiler above the fire line is harmless; but if it adheres to the inside of parts that are, on the outside, exposed to the direct action of the fire, the transmission of the heat to the water is obstructed and the metal is damaged by being overheated and cooled repeatedly. Larger deposits of scale are likely to take place at the longitudinal seams on account of the presence of rivet heads and the edge of the lap; particularly when the inner edge is upward, forming a ledge for the lodgment of the precipitated solids. Longitudinal seams are the weakest line of a cylindrical shell, and should never be exposed to the fire.

"And would not the hinge-bending motion referred to as caused by variations of pressure on the flattened portion of the boiler at the double riveted seam be intensified somewhat by the quick motion cut-off of an engine . . . which *did cause* a variation of three pounds of steam, as indicated by the steam gauge at every stroke of the piston?"

Answer, Yes. Sixty-nine revolutions means one hundred and thirty-eight pulsations per minute.

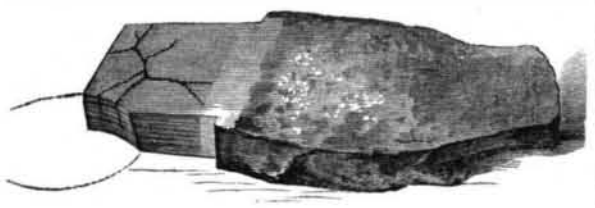
The regular strain on the iron of a sixty-inch cylindrical shell at ninety pounds pressure is $90 \times 30 = 2{,}700$ pounds per lineal inch of longitudinal section of the unpunched plates, 30 being the radius of the boiler in inches.

Now, provided the momentum of the gauge pointer did not show an exaggerated indication of actual variations (it is probable that it did exaggerate), then we have $\frac{8}{2700}$, or more than one pound for every thousand pounds of the maximum load alternately added to and taken from it more than eighty-two thousand times in ten hours. But these impulses are not cumulative or similar to those of a dog trotting upon a long bridge span, as some persons suppose.

The boiler now under consideration, if it had been sound and good, would have had an ample margin of strength for all such pulsations and shocks as are incidents in the use of every steam boiler.

As bearing on this question, we ought to consider the great number of similarly situated boilers, not only in the Miami Valley, but in other places where cut-off engine and bad water are used. Hundreds of such boilers have endured for many years the same things to which this one succumbed in less than one year. It was new in December, 1880, and exploded in October, 1881. The variations of pressure from which distorted shells, or those that are otherwise weak, suffer most, are the extremes which occur daily in most land boilers, from zero to the maximum pressure. These are less frequent, but give greater motion at the weak line. Such are the variations meant in the SCIENTIFIC AMERICAN'S report of the explosion.

The assumption that the iron was originally good where it gave way appears not to be sustained by the condition presented by the iron itself. A chemical test, so simple that any mechanic may apply it, has been used by us upon a sample of the iron from the broken plate, and it reveals serious defects that were not visible to the eye prior to the test.



This sketch is a faithful representation of a fragment of five-sixteenths inch boiler plate from the exploded boiler at Dayton, which was broken from the edge of a longitudinal line of rupture, near a seam on the right-hand side of the boiler. It was twisted off with a wrench after having been nearly detached at the time of the explosion, and prepared for experiment by filing the portion bounded by the straight lines, both on the two surfaces and on the edges. When thus prepared there were no indications to the eye of either crack or lamination. The piece of iron was then suspended in a bath of dilute hydrochloric acid and bichloride of platinum, to the depth shown by the lines on the front edge, for about twelve hours, and when cleaned off with a stiff brush and cold water it presented the appearance shown by the engraving, revealing bad cracks in the iron and poor material.

The dotted circle indicates the locality of one of the rivet holes of a double riveted longitudinal seam on the right-hand side of the boiler at the end of the third top plate from the rear end, the corresponding seam on the adjoining second top plate from the rear end being the line of weakness and of initial rupture. The acid first attacked and more rapidly dissolved the porous portions of the plate that had been damaged by strains when the punching was done, and also the porous lines between solid iron of the laminæ.

The acid bath above referred to consists of dilute hydrochloric acid, one part of strong acid to four of water, to which add, of bichloride of platinum, about two drops to the ounce of the dilute acid, and let the iron remain therein from twenty-four to thirty-six hours. The parts that have been damaged by working, should there be such damage, will be first acted on and the defects will be brought to view.

In respect to the small flanged boiler head sketched by our correspondent, it was examined by the representative of the SCIENTIFIC AMERICAN before the publication of our verdict on this explosion, who was satisfied on seeing it that the iron was "*cold short*," because the flanging was done while the iron was hot; and as to the cold bending of strips by the committee, it is a fact that the iron broke before it was bent to half a right-angle on a curve of fair radius.

Notwithstanding the assurance of our correspondents that there is not a flaw or crack anywhere to be seen in the flanged specimen, and which was personally examined by the committee and pronounced good, still the SCIENTIFIC AMERICAN is of opinion that there is a mistake somewhere, and that by thoroughly submitting the specimen to the acid bath above described, cracks and poverty of the iron will be proven to exist.

A New Dental Disease.

A child, aged ten, whose teeth six months ago appeared to be all perfectly sound, came to me with toothache in the right lower canine. I found that a large portion of the enamel had disappeared from the front surface of the tooth, as if it had been chipped violently off; the dentine was all exposed, but there was no softening or appearance of decay. The disease, which has commenced in several of the other incisor teeth, appears first as a small white spot in about the thickest part of the front surface of the enamel, which it seems to penetrate; and then, suddenly disintegrating, this comes away, and exposes the remaining sensitive enamel and the dentine. This disease is altogether a different thing from the gradual decay, or wear at the neck of the teeth, frequently met with in adults, for in this case the patient is only ten; and, as far as I have been able to ascertain, the incisors and canines never have been known to decay in the manner above described. We are often at our wits' end to cope with the increasing prevalence of caries in the teeth of the very young; and if this be (as I fear it is) a new form of destructive energy, the sooner it is recognized the better.—*N. Stevenson, British Medical Journal.*

Increasing Safety of Steamboat Travel.

The annual report of Gen. Dumont, Supervising Inspector-General of Steam Vessels, shows an encouraging decrease of 29 per cent in the number of lives last during the past five years compared with the preceding five, notwithstanding an increase of 59 per cent in the number of passengers carried. The figures for the several years are as follows:

Year.	Number Lives Lost.	Passengers Carried.	Steamers Inspected.
1872	306	123,000,000	3,444
1873	301	121,835,085	3,743
1874	195	120,000,000	2,879
1875	607	114,000,000	4,006
1876	393	118,280,000	3,947
Total	1,802	597,115,085	19,819
1877	211	122,000,000	4,149
1878	212	131,420,000	4,252
1879	177	223,880,537	4,416
1880	185	225,000,000	4,536
1881	268	230,000,000	4,779
Total	1,053	932,500,537	22,132

General Dumont recommends a large reduction in the tax upon licensed officers of steam vessels. He would have the inspector's fee for granting certificates reduced to 50 cents. It now averages $7.50.

Ancient Stone Remains on Summit of Rocky Mountains.

At a recent meeting of the Kansas Academy of Science, a paper by J. R. Mead, of Wichita, was read as follows:

During the past summer I had occasion to travel over and along the continental divide which separates the waters of the two oceans, as well as the counties of Gunnison and Chaffee, Colorado, and at a point about four miles west from the town of Monarch, near the head of the South Arkansas, I noticed the *débris* of very ancient works of stone, which, considering their location, were very curious and interesting. They comprised a series of low stone walls, and extending along the smooth summit or backbone of the mountain and connecting two elevated rocky points, about a quarter of a mile apart. On the top of these points were circular inclosures of stone, ten or fifteen feet in diameter, and two feet in height; the walls were made by placing upon edge and leaning together slabs of granite rock, and were originally about two feet or more high, and are so ancient that in many places the granite rock of which they were composed had disintegrated and crumbled into sand. The course of these walls was generally north and south, with frequent dips, spurs, and angles, side walls, and pens, forming an intricate system. The design of it was difficult to comprehend. These marks extended across a convenient top in the mountains, at an altitude of about 11,000 feet, and above timber line. They could hardly have been intended for defense, as the mountain range could be crossed as easily for several miles south as at this point, and I could not see that they would be of advantage in the capture of game. I have heard of such walls on the summit of the mountains further north, from several parties; these are the only ones which I observed in my travels. Their origin and purpose may ever remain a mystery. I have implements of stone picked up in that locality.

Life Preservers in Factories.

The compulsory provision of life preservers on steamers, and their manifest utility, suggest to a correspondent the propriety of a law compelling factory owners to provide at each window a cheap and efficient fire escape, in addition to the appliances and stairways now required. One that would always be ready, easily understood, and usable by any person of ordinary intelligence, even under excitement, could be made in the following manner:

To a staple firmly driven in the wall immediately over each window attach a rope or cord, say three-eighths of an inch in size, and long enough to reach nearly or quite to the ground. This cord should be well made and pliable, and might be knotted at intervals of about fifteen inches. The cord should then be rolled into a coil or ball, and tied in place by a small cord or strap, ready at a moment's notice to be untied and the end thrown out of the window. Men, and even women, could descend it with little difficulty, or the stronger and cooler-headed could tie the rope about the bodies of the weaker and quickly lower them to the helpers below.

THE limiting depth to which light penetrates in water was some time ago stated to be 40 meters for Lake Leman, by Prof. Forel, who used albumenized paper in his experiments. M. Asper has recently made similar experiments on the Lake of Zurich by a slightly different method. He used the photographic plates called *emulsion plates* (more sensitive than albumenized paper), and immersed them during the night of August 3, to depths of 40, 50, 60, 70, 80, and 90 meters. They were brought up after remaining twenty four hours in the water, and treated with oxalate of iron. All the plates, without exception, were distinctly affected by the light. Thus the chemical rays penetrate in clear water to at least 90 meters deep.