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EXPLOSIONS OF BOILERS—RENEWED DISCUSSIONS OF THEORIES.

No subject has been more frequently discussed than "the cause of steam boiler explosions." It is one of those questions which in its very nature demands frequent attention. New circumstances and repeated calamities call for further investigation and discussion. The subject has lately been before the Academy of Sciences in Paris; and communications upon it have appeared in the London *Engineer*, *Mechanics' Magazine*, and one in the New York *Daily Times*. Various and contrary theories have been presented. All cannot be right, but each should be carefully examined and candidly judged. The author of the article in the New York *Times* calls attention to "the momentous issues which hang" upon the boilers of the three hundred steamers now employed by the Government, and says:—

Quite recently, while experimenting for a very different purpose, Mr. Edwin Stevens, of Hoboken, developed the great fact that water cannot exist as water, under the atmospheric pressure, at a higher temperature than 212°. Now, the temperature of the water in a boiler under steam pressure of 100 lbs. is 330°. If, then, the steam, pressing on this water, can instantly escape, as through a rupture caused by mere weakness of the metal or by overpressure, a great part of this water at 330° will instantly flash into steam, carrying the rest with it at about the velocity of a cannon ball. So far we know. The theory is, that this flying body of inelastic water particles operates like so many projectiles—like a broadside of grape—tearing into pieces everything within reach. Thus explosions start in simple ruptures, and ruptures always result from carelessness.

It is generally admitted that an explosion is caused by a pressure of steam greater than the metal of the boiler can withstand. Some explosions have probably occured by overpressure gradually accumulated, but many have undoubtedly been caused by overpressure from a great quantity of steam suddenly generated, its mechanical action being similar to the ignition of gunpowder in a confined space. A variety of opinions exist with regard to the cause of the rapid generation of steam in many cases. The rupture theory, presented in the above extract, is liable to the charge of being illogical. As an explosion cannot take place in a boiler after a rupture, unless the pressure is subsequently greatly elevated, it is apparent to reason, that all the steam generated by the surplus heat in the water, must be of a reduced pressure to that which produced the rupture. The molecules of water are so mobile that they cannot produce an effect like grape shot. The scientific world will certainly be astonished to be informed at the present day, that Mr. Stevens developed the fact that water heated above 212° cannot exist as water under atmospheric pressure. It is one of the most widely known facts of science.

Another cause of the rapid generation of an overpressure of steam, is the use of water deprived of atmospheric air in the boiler. In 1847, Professor Donny, of Ghent, in making some experiments, discovered that water deprived entirely of atmospheric air could be heated to 275° Fah., without boiling, but when elevated a few degrees above this point, it flashes into steam with the rapidity of a gunpowder explosion. Boilers kept under fire for some time, with deranged feed pumps, are deprived of atmospheric air, and they thus, according to Professor Donny's discovery, become as dangerous as gunpowder magazines in the vicinity of a conflagration. Many very violent boiler explosions of an apparently mysterious character may be explained by this theory, which has lately been discussed in the Paris Academy of Sciences. The use of Giffard's injectors, in place of feed pumps, whereby a constant supply of water containing air is furnished to boilers, when standing still as well as when the engine is running, should prevent explosions from this cause.

Various other theories respecting the causes of steam boiler explosions have been presented to the public. We cannot now occupy space for their reproduction. Our subject, at present, principally is to direct the attention of scientific and practical men to the subject for more careful and profound investigation. Many explosions have lately taken place, both at home and abroad, and an apparent mystery seems still to hang over some of them. We are positive, however, that most of the boiler explosions which have taken place, can be traced to ignorance or carelessness on the part of those who were entrusted with their management. All such catastrophes may be prevented by care, proper attention and intelligence, admitting either of the theories presented to be correct. Since no less than 300 steamers are now employed by our Government, and under very exciting circumstances, unceasing vigilance over the boilers should be exercised by all our naval engineers. Thus far they have given a good account of themselves.

INDIAN CORN FOR ENGLAND.

A correspondent of *The Prairie Farmer* in England, pays a glowing tribute to indian corn, and states that England to-day wants cheap bread for her people more than all other things, and America can give her this. The people of England are feeling the calamities of this war more than those of our northern States, because hundreds of thousands of them are deprived of employment on account of the stoppage of the cotton factories. Indian corn, he believes, can supply them with cheap bread, and Illinois alone can furnish almost all that is necessary. Little is known in Great Britain, however, respecting indian corn. It is chiefly regarded as food for animals, and as being totally unfit for human use. This is not surprising, as most of that which arrives at British ports is musty, and this is the point to which we wish to direct the attention of grain shippers. It is asserted by this correspondent that all the corn which he has seen in Europe is no better than that which is rejected by inspectors at Chicago. That which is designed for transportation should be kiln dried, and when designed for bread in England, it should be bolted like wheat when it is ground. On our lake boats, canal boats and ocean vessels which carry grain, too little care is bestowed upon it, to keep it dry and well aired. Corn when shipped in bulk is very liable to heat and become musty, especially when kept in the holds of vessels, where the atmosphere is always damp, and where no provision is made for ventilation. To carry grain properly on water, it should either be kept in perfectly air-tight bins, or it should be frequently turned over and currents of fresh air driven through it. Millions of bushels of wheat and corn are ruined annually by the carelessness of those who carry them and the inefficient means which they employ for securing such grain from injury.

OUR IRON-CLAD FLEET.

The number of iron-plated vessels, including those finished and those in process of construction for the United States Government is stated at the present time to amount to 49. Of these 21 are for the Western waters and 27 for the Eastern coast. These have all been described in our pages with the exception of the first of the Western gunboats, and a good idea may be had of these from the description and illustration of the ram, *Arkansas*, in our present number.

FILLING OF THE GREAT RESERVOIR.

The water was let into the new reservoir located in Central Park, this city, on the 19th inst. It is one of the greatest artificial water basins in the world. The entire space inclosed is 106½ acres, and 96 are covered with water. It is 30 feet deep and can hold one billion of gallons. The reservoir is divided into two great compartments by a bank 33 feet in hight, 117 wide at the bottom and 15 feet at the top. Its form is irregular, which is due in a great measure to the nature of the ground. A vast amount of rock blasting was necessary to obtain the requisite depth. It has three gate houses, the banks on the inside are faced with cement, on the outside they are covered with grass. This reservoir will afford a large stated supply of water to the city, if one or several of the main distributing pipes should accidentally be injured. It is over three years since its construction was commenced, and it cost $1,500,000. It is a beautiful artificial lake and adds greatly to the attractions of the Central Park, while it furnishes the city with "its crystal drafts of heaven distilled beverage."

THE POST OFFICE—ITS RISE AND PROGRESS

The Post Office has formed an important department in every civilized country since the days of Cyrus, the Persian, who is accredited with the origin of regular postal arrangements between different parts of his empire. His couriers, however, only carried government dispatches, still this was the initiation of the system. The Germans claim that a regular postal system for carrying the letters of citizens was first adopted in the Republic of the Hanse Towns in the thirteenth century, and from thence it extended to other parts of Europe. No well defined system existed in England up to the reign of Charles I., who, by royal proclamation, established post offices in various cities and towns in England and Scotland, and transmitted the mails regularly between them. In those days the mail bags were carried on horseback and on foot, as traveling by carriages was unknown, and macademized roads had not been invented. No provision, however, was made for the transmission of letters inside of cities until about 1663, when an upholsterer in London, named Robert Murray, set up a penny post and express, and delivered letters and parcels several times every day in various parts of that city. This enterprise was very beneficial to the merchants and people, and it promised to be lucrative to its author; but the Duke of York (afterward James II.) claimed that it was an infringement of a post office monopoly granted to him by his brother the king, and so the profits of the first London penny post went to swell the revenues of the selfish duke.

In 1692, a postal system was projected for the American colonies, but it was not organized until 1710. In 1753, Benjamin Franklin was appointed Postmaster General for the colonies, and his practical mind soon devised superior modes of managing the details and improving the revenues. In 1789, the adoption of the Constitution conferred the power upon Congress of managing the post office. In 1790, there were only 75 post offices in the United States, and the total revenue was but $37,935. The rates of postage from the new organization of the department until 1816, were for a letter written on a single sheet of paper 8 cents, carried a distance under 40 miles; over this and under 90 miles 10 cents; over this and under 150 miles 12½ cents; over this and under 500 miles 25 cents. These rates were modified, but not reduced in 1816, and so continued for many years afterward although they were felt to be very high. In 1836, the Hon. Edward Everett brought up the subject of reducing the postal rates in Congress; but no well digested plan was offered for adoption. About this period nearly the same rates of postage prevailed in Great Britain, but a new Parliament elected under the Reform Bill had come into power, and one member of it—Mr. Wallace, of Kelly—had resolved to devote his energies to reforming the post office, and he was ultimately successful. No proper occasion was neglected by him in introducing the subject, and he succeeded in obtaining the appointment of a committee te investigate the whole system and report to Parliament. An original and practical man in the person of Mr. Rowland Hill, a secretary in one of the Government offices, had his mind directed to the subject, and by a thorough examination of the income and expenditures and the modes of conducting the post offices and carrying the mails, he came to the conclusion that a universal penny post system for the United Kingdom would be successful. He, therefore, made his plans and proposed the new system for adoption. At this period—1837—there were but 76 millions of letters carried annually by the British Post Office, and to pay all expenses by the new system it required 380,000,000 letters to be carried. Mr. Hill calculated that the reduced rates of postage

would vastly increase the number of letters, and his method combined improved modes for reducing the expenses of managing the offices. In the strong faith that such an increase would be obtained in a few years at furthest, the Reform Post Bill passed Parliament in 1839, and went into operation in 1840. There was a deficit in the first year after it went into force, but the revenues have been steadily increasing ever since, and last year—1861—the stupendous number of 593,000,000 of letters were carried. In 1839, the number of letters carried for each person in England was 4; in Scotland 3; in Ireland 1. Last year it was 24 for each person in England, 19 in Scotland and 9 in Ireland. In 1838, the revenue of the British Post Office was $11,734,390 in 1861, $16,500,000. Notwithstanding there has been such a reduction in the rates of postage and such an increase of mail matter to carry, the use of stamps, and the improved modes of travel by steamboat and railway have actually reduced expenses, for there is now a surplus revenue of $7,500,000 per annum.

Besides the organization of a cheap postage system for letters, Rowland Hill introduced the carrying of books and small parcels by the post office, and no less than 12,000,000 of book packages were carried by this method in England last year. Another important improvement also introduced was the money order system, by which money paid into any British post office can be drawn by order at any other. The value of money orders thus transmitted last year was $73,081,700.

The success of Rowland Hill's cheap and comprehensive postal system soon attracted attention in America, and in 1843 the Postmaster General—Mr. C. A. Wickliffe—presented an elaborate report on the subject, and proposed some reduction of the previous high rates. In 1845, a bill was passed by Congress reducing the previous high rates to 5 cents for every letter under half an ounce in weight, carried 300 miles, and 10 cents for all over that distance. In 1851, 1852 and 1855, these rates were modified and other alterations made in our postal system. The rates now established are 3 cents for a single letter for all distances under 3,000 miles and 10 cents for distances over this. All inland postage must be prepaid; circulars and transient newspapers under 3 ounces 1 cent; every additional ounce 1 cent; periodicals published monthly, and pamphlets of not more than sixteen octavo pages, sent in packages of not less than 8 ounces, ½ cent per ounce prepaid; 1 cent if not prepaid. Books less than 4 pounds under 3,000 miles 1 cent per ounce; over this distance 2 cents per ounce, and fifty per cent added when not prepaid. In 1852, postage stamps and stamped envelopes were ordered; and the only modifications adopted of late years have been the street letter boxes on the lamp-posts, and the reduction of city carriers' fees to one cent per single letter. Exchange newspapers, magazines, &c., sent to editors are free; weekly newspapers to subscribers in the county of publication are also free; out of the county and under 50 miles, 5 cents per quarter; over 50 and under 300, 10 cents; over this and under 1,000, 15 cents; over this and under 2,000, 20 cents; over this and under 4,000, 25 cents. Monthly papers and semi-monthly half of these rates, and if paid quarterly in advance a reduction of one half is made.

The franking system by which members of Congress can send letters and packages free by post, belongs to the worn-out privileges of the English Parliament. From the Postmaster General's report of 1861 we learn that there are 28,620 post offices in all the States. The total revenue for the year was $9,049,296; expenditures $13,606,759. Thus, while the revenues are about three million of dollars less than those of Great Britain, the expenditures are $4,606,000 more. The excellent roads in England, the small extent of country with its dense population render the carrying of the mails very much less expensive in that country than in the vast territory of the United States with its sparsely settled population. We must not overlook the fact, however, that there are about three times the number of letters sent by mail in Great Britain than in the United States, and besides this a considerable revenue is derived from the money orders. This system was imperfectly tried for a short period about fifteen years ago by our Post Office and given up. We think it should be tried again. It is a most convenient method of transmitting money in small sums. Another reform for improving our postal system would be the reduction of the high rates for ocean postage to Europe. For a single letter the rate to England is 24 cents, which is too high. Our Government has proposed a reduction but this cannot be brought about without the mutual action of foreign governments. We trust this question will be persistently agitated until the desired reform is effected, and single letters between America and Europe carried for five, or at most ten cents. The British ocean postal system is managed with great ability. The Cunard Company have carried the mails for twenty-two years, have never broken a contract, incurred no penalties, and never asked an indulgence, as we learn by some remarks made in Parliament. Twelve mail steamers are maintained by British subsidies on the western coast of South America, securing a large trade which naturally should rather belong to the United States.

MANUFACTURE OF SALTPETER.

The successive Governments of France have, for many years, encouraged every invention and improvement in the production of nitrate of soda, to render them, if possible, independent of England for the necessary supply to the gunpowder works. The artificial niteries or niter beds collected for this purpose, consist of animal matter, the rubbish from the walls of old houses, stable litter, refuse of plaster works, &c. The decomposition of the animal matter produces carbonate of ammonia, which, dissolved in water, in connection with the air charged with oxygen, is transformed into nitrate of ammonia. This product, under the influence of the solar ray, and the action of time decomposes the calcareous and magnesia carbonates in the plaster rubbish, forming nitrates of lime and magnesia and reproducing carbonate of ammonia, which, set at liberty, serve anew to form the nitrates. According to this theory, the nitrate plays a double part; it serves to reunite the elements of the atmosphere to produce nitric acid, and it causes this acid, formed under its influence, to act on the insoluble carbonates, to change them into nitrates. But this action is not the only one; for Kuhlmann discovered that in most instances the ammonia itself was decomposed, and that its nitrogen, combined with the oxygen of the atmosphere contained in the water, is thus transformed into nitric acid. These calcareous and other earthy nitrates dissolved in water are decomposed by sulphate of soda, thus forming nitrate of soda and sulphate of lime by double decomposition. The nitrate of soda is then heated with chloride of potassium and nitrate of potash (saltpeter), and chloride of sodium (common salt) obtained.

Saltpeter is obtained in the Mammoth Cave, Kentucky, and considerable quantities were obtained from this source during the war of 1812. It is derived chiefly from the excrements of bats, &c. Most all the saltpeter which is employed for the manufacture of our gunpowder comes from India. It is not known whether any saltpeter is now obtained from natural sources in the Southern States. If the secessionists were deprived of this substance entirely, they could not carry on a war. The nitrate of soda is very abundant in many parts of the world, and were it not so deliquescent, it would answer just as well for making gunpowder as the nitrate of potash (saltpeter).

The formation of natural saltpeter is a very slow process, requiring about two years to complete. During the French revolution 2,000 tuns were made in one year in Paris, and were foreign supplies cut off twice this quantity could be made in the same space of time in the city of New York with its present number of inhabitants. In Sweden, each peasant who owns a house is bound by law to make a certain quantity of saltpeter every year for the use of the state. In Spain, Egypt, Persia and especially India, vast quantities of this salt are made annually; and it is not only a source of great profit but of warlike power to great Britain.

A Plain History of Iron Plated Ships.

On another page will be found a lecture by the eminent engineer and ship builder, John Scott Russell, on iron ships. Those who have not followed the development of this great subject, which is absorbing the attention of all maritime nations, will read Mr. Russell's lecture with interest, as it is a brief, able and intelligent discussion of the whole subject, while those who have kept themselves informed in regard to the question, will be still more interested in the lecture. Mr. Russell's award of credit to Stevens, exhibits a manly frankness, which we think is characteristic of the really highest class of Englishmen, those of large and cultivated intellects.

VALUABLE RECEIPTS.

Copperas a Disinfectant.—To disinfect a cesspool, dissolve half a pound in a pailful of warm water and throw it in. If the sulphate of iron be dissolved in water and thrown into cesspools it renders them pure, even where the gas is in such quantity as to be oppressive to the lungs and irritating to the nose. The rationale of the process is this. The sulphuric acid of the salt combines rapidly with the ammonia, forming a sulphate of ammonia, and the iron is thrown out as an oxide. This salt of ammonia (sulphate) is very soluble in water, and to a great extent inodorous. In addition to this, the ammoniacal gas is most rapidly absorbed by the water of the solution, and thus arrested until the sulphuric acid has time to leave the iron and unite with the ammonia.

Preparing Glue for Ready Use.—To any quantity of glue use common whiskey instead of water. Put both together in a bottle, cork it tight and set it for three or four days, when it will be fit for use without the application of heat. Glue thus prepared, will keep for years and is at all times fit for use, except in very cold weather, when it should be set in warm water before using. To obviate the difficulty of the stopper getting tight by the glue drying in the mouth of the vessel, use a tin vessel with the cover fitting tight on the outside to prevent the escape of the spirit by evaporization. A strong solution of isinglass made in the same manner is an excellent cement for leather.

Mahogany Stain for Wood.—The planed surface of the wood is first rubbed with dilute nitric acid (aquafortis), made with one ounce of the acid added to eight of water. One ounce of dragon's blood is dissolved in nearly a pint of spirits of wine, this and one-third of an ounce of carbonate of soda are then to be mixed together and filtered, and the liquid in this thin state is to be laid on with a soft brush. This process is to be repeated, and in a short interval afterward the wood possesses the external appearance of mahogany. When the polish diminishes in brilliancy, it may be restored by the use of a little cold drawn linseed oil.

To Obtain Fresh Blown Flowers in Winter.—Choose some of the most perfect buds of the flowers you would preserve, such as are latest in blowing and ready to open, cut them off with a pair of scissors leaving to each, if possible, a piece of the stem about three inches long; cover the end of the stem immediately with sealing wax, and when the buds are a little shrunk and wrinkled, wrap each of them up separately in a piece of paper, perfectly clean and dry, and lock them them up in a dry box or drawer; and they will keep without corrupting. In winter, or at any other time, when you would have the flowers blow, take the buds at night and cut off the end of the stem sealed with wax, and put the buds into water wherein a little niter or salt has been diffused, and the next day you will have the pleasure of seeing the buds open and expand themselves, and the flowers display their most lively colors and breathe their agreeable odors.

Lake Iron Propellers.

This is truly the "Age of Iron." Even on our Northern lakes, where timber is so cheap for shipbuilding, iron is taking the place of wood. A splendid new iron propeller, called *Merchant*, built at Buffalo, N. Y., has lately made her first trip to Chicago, and the papers of the latter city describe her in flattering language. She is to constitute one of a regular line of iron propeller steamers running between Buffalo and Chicago, touching at Milwaukie. All screw steamers should be built of iron. The peculiar action of the screw upon a wooden vessel tends to open her seams, and thus frequent repairs are rendered necessary. An iron vessel, on the other hand, is much stronger in the frame, and the plates being riveted, they do not work loose like the bolted planking of a wooden propeller.