

It has been shown that the indicator cannot always be relied upon to accurately measure the power. The qualities of coal vary so much, also, in different localities, that the amount consumed does not furnish an accurate comparative measure of the cost of the power. When the coal measure alone is used, too, the engines and boilers are both tested together, which gives no opportunity to ascertain which of the two is entitled to the credit of the performance. This standard will not then answer the purpose of a scientific investigation. In such case we must ascertain, in addition to the coal, the amount of water evaporated; we can then estimate the value of the coal, and the separate efficiency of both the engine and boiler. The value of the coal, and the efficiency of the boiler, are shown by The Number of Pounds of Water Evaporated per Pound of Coal, and the economy of the engine as compared with that of others by calculating The Number of Pounds of Steam Used per Horse Power per Hour. The weight of the steam used is, of course, the same as that of the water evaporated.

In all ordinary practical trials, the economy must be determined simply by the quantity of fuel consumed to produce the power. Hence we will first try and find a solution of the difficulties which attend this kind of measurement.

THE FUEL.

The different kinds of fuel vary so much in value that it is impossible to accurately compare them. Coal being most generally used, is the natural standard; but there are so many varieties of this necessary article, varying greatly in quality, that it seems a hopeless task to try and compare the performance of steam engines in different parts of the world, or even of our own country, by the consumption of differing coal, which may vary twenty per cent in heat producing power. The best way is, evidently, in comparative trials, to use selected coal from the same mine. Yet, how rarely can this be done? and even if this precaution be taken, in certain cases, how can a comparison be made with the results obtained by others widely separated, and possessing, possibly, different views? We must say that the problem cannot be solved with scientific accuracy; still we are able to suggest some corrections which will reduce all varieties of good coal to substantially the same standard, and thus enable us to use this measure in simple practical trials.

We cannot examine in this paper, with any minuteness, the chemical constituents of the different varieties of coal. For our purpose we will simply divide them into two portions; namely, the non-combustible and combustible.

The non-combustible portion consists, for the most part, of earthy matters, though oxygen and nitrogen gases are often present; and most coals absorb considerable water. The combustible portion consists of carbon and hydrogen, the first largely predominating. In American anthracite about three per cent of the combustible is hydrogen. The semi-anthracite combustible contains about five per cent; and the bituminous varieties a large proportion, varying with the locality of the mines. It is authoritatively stated, that, in some varieties of Ohio and West Pennsylvania coal, the hydrogen element is often twenty-four per cent of the whole combustible. For the consumption of equal weights of hydrogen and carbon, the first requires three times as much oxygen as the latter; the heat resulting should therefore bear a somewhat similar proportion. Favre, Sieberman, Andrews, and others, have, from experiment, estimated the calorific value of one pound of carbon to be the heating of about 14,000 pounds of water, one degree Fahrenheit. The corresponding value of hydrogen was similarly determined to be about 60,000 heat units. Bituminous coal, containing considerable hydrogen, should therefore produce a very much more heat in combustion than anthracite; but in practice the difference is comparatively small. Mere differences in mechanical structure appear to have a greater influence than chemical constitution. The reason is not evident. The latent heat of the steam resulting from the combustion of hydrogen, which is lost in the atmosphere, will not nearly account for the discrepancy. Without attempting an explanation, except perhaps imperfect combustion, we can, for our purpose, only turn to the records of practical experiments, and find what different kinds of coal have done, and may therefore be expected to do again.

Bourne gives the evaporation efficiency of thirty varieties of coal from different parts of the British Isles, or from 7 to 10.2 pounds of water from a temperature of 212°. The average was 8.7 lbs. These coals are, as is well known, of the soft or bituminous variety. The results of experiments made by the Navy Department, with thirteen varieties of American anthracite, from different parts of the Pennsylvania coal field, gave a mean evaporative efficiency per pound of coal of 8.9 pounds of water, from a temperature of 212° Fah. Three specimens of American bituminous coal gave a mean result of 9.9 pounds, under similar conditions. These figures make it appear that our American coals are superior to those of other nations. Professor Johnson, at an earlier period, made some experiments for our Government, with smaller quantities, but obtained more marked results in the same direction. On the contrary, the engineers of the English and French steamers, out of this port, speak of our Cumberland and kindred varieties of coal as inferior to those procured at home. We are in search of the truth, and cannot therefore cater to national vanity. Our best bituminous and clean, free-burning anthracite coals are undoubtedly better than can be found in large quantities in any other part of the globe. All must admit, however, that some of our American bituminous coals are almost identical with the English in appearance and chemical constitution. Both should therefore give the same results, when tested under the same circumstances. In the experiments above mentioned, the English coals comprised a greater number of kinds, the bad being

averaged with the good. The United States Government experiments were tried with the greatest care, and in a boiler better proportioned for economy, probably, than the average in England. On the whole, we think it fair to assume that the English and American bituminous coals, of the qualities ordinarily supplied to the market, are substantially equal in value, though selected varieties, fresh from our mines, would of course give much better results.

The Government experiments above mentioned showed that the evaporative efficiency of the American anthracite, and the American bituminous coals are in the proportion of 8.9 to 9.9.

(To be continued.)

The California Earthquakes—A different System of Building Necessary.

W. Frank Stewart, Esq., published a series of articles in the *San Francisco Alta.*, in 1865, called forth by the earthquake of October of that year, an extract from which will be read with interest at the present time:

"When the solid land trembles and gyrates beneath us, like a disabled ship upon the waves; when the substantial habitations of men come toppling headlong to the ground, and when the startled populace, with blanched lips and whitened visages and smiting knees, rush shrieking and howling into the streets, the appalling phenomenon may be a matter of levity to the learned, but for my part, I have yet to discover 'where the laugh comes in.'

"In this region, together with the visible evidences that, at no very remote period, the country has experienced far more powerful shakings, are warnings which sensible people cannot disregard. There are old settlers still surviving in California who have witnessed convulsions of the earth which would have demolished the most substantial building in San Francisco. Only a few years ago an earthquake occurred which opened a chasm in Salinas Plains, which is yet plainly traceable for a distance of fifty miles. During the shock of the 8th of last month (Oct., 1865), the ground to the north of San Juan was rent into innumerable fissures all along the stage route. Will any sane man contend that if these cracks and chasms had occurred in a similar manner on Montgomery street, the lofty brick shells along that thoroughfare would have remained uninjured? It is utterly beyond the limit of possibility that a perpendicular brick wall, sixty feet in height and only one foot in thickness, could stand up under such circumstances.

"I know it is dangerous to make predictions, but, guided by the experience of the past and by the deductions of science, I shall hazard the opinion that every brick and stone building now on the coast of California will be thrown down by an earthquake, unless mechanical skill can render them more secure than they now are. Men may smile at my suggestion of 'pyramidal walls,' but the day is not far distant when our present shell walls will not be considered particularly safe."

Mr. Stewart, who is said to have devised a means for determining the time when earthquakes may be expected to return, and who has given so much attention to the subject that he has acquired the title of the *Earthquake Seer of San José*, according to the *Argus*, of that city, made a prediction that an earthquake would be felt of greater force than had ever been witnessed since the settlement of the coast by Americans. His confidence was so great in the truth of his prediction that he backed it with a bet, and of course has won.

Editorial Summary.

EXPLOSION OF A SOAP TANK.—A saponifying tank in a soap and candle factory in Cincinnati exploded on Nov. 4th. Two workmen in the factory were badly scalded by the hot stearine, but a number of others, men and women, employed escaped uninjured. The tank, twelve feet long and six feet in diameter, was projected upward some five hundred feet and alighted a distance of two and a half squares from the point of explosion. The tank had for years borne a pressure of from eighty-five to ninety pounds per square inch, receiving its steam direct from the boiler, the steam being used to separate the glycerin from the tallow.

THE WORLD intimates, not without reason, that members of Congress are selling their frank to further private enterprises and personal schemes. We have repeatedly called attention to the abuse of this privilege, and we have now before us a letter from a western correspondent in which he asserts that he received fifty copies of a pamphlet of a swindling patent agency at Washington under the frank of John A. Logan, M. C., (Pub. Doc). We prefer to think that Mr. Logan knows nothing about the business, but be that as it may, it is a fraud upon the postal revenues.

ACCORDING to the returns made to the United States Assessors, the total value of the boots and shoes manufactured and sold in Lynn, during the three months ending Oct. 1, was \$3,483,477. This does not include goods made by the smaller manufacturers, whose sales do not amount to \$5,000 annually, which amount, added to the above, would give a total of at least three and a half million dollars for the past three months. For the corresponding period last year the sales amounted to \$3,214,060.

WE see it stated that Liebig, the chemist, complains that people are forever pestering him with letters asking questions of the most extraordinarily silly nature, such as they might answer for themselves by consulting any elementary textbooks. They come at the rate of two or three hundred a day and in eight or ten different languages.

A PARTIAL obscuration of the sun has recently been made the subject of observation and comment in California. Many attributed this to a smoky condition of the air caused by distant fires in the woods. The California Academy of Sciences have taken the subject into consideration and have decided that the extreme heat and dryness had caused the moisture from the fog to disappear, and left the silicious and saline matters contained in it suspended in the air.

MANUFACTURE OF SUGAR.—A German paper mentions a new process of refining sugar in which the saccharine juice, after being clarified in the usual way by means of lime and carbonic acid, is precipitated at boiling temperature with caustic baryta (60 parts of the latter for every 100 of sugar), the precipitate suspended in water and decomposed with carbonic acid. A pure solution of sugar is obtained, which only requires to be evaporated.

IT is announced that an important discovery of iron ore of a superior quality for the manufacture of steel has been made near Ellenburg, Clinton Co., N. Y. The situation of the vein is said to be very favorable, being in the immediate vicinity of everything necessary to its profitable working. By all accounts the quality and quantity of ore in the new mine bid fair to rival if not excel those of the Peru mine in the same county.

ALONG the lines of the principal railways in England the self-delivery mail bag arrangement is now in use for express trains. The Crane Hook delivery is soon to be put in motion at the several way stations between Boston and Springfield. The mail bag is suspended on a hook at the station, and is taken off by a hook fixed at the same height on the mail car.

A POWERFUL LENS.—Mr. Parker of London, has just made a lens, three feet in diameter, three inches thick in the center, and weighing two hundred and twelve pounds. In the focus of this powerful lens the most refractory metals are, almost instantly fused and dissipated in vapor, while unyielding stony substances are as readily vitrified.

OLE BULL, after charming for years the musical world by his skillful performances upon the violin, has at last, it is said, turned inventor. He has invented an improvement in sounding boards for pianos, by which the sound can be prolonged. This has been a long sought desideratum.

THE *Rural New Yorker*, advertised in this number is one of the very best agricultural and family journals in this country. It is to be enlarged to sixteen double quarto pages, and otherwise improved.

CHASSEPOT has commenced a suit against the French Minister of war for \$200,000 due him on a rifle contract. His rifles are pronounced worthless, hence payment has been refused.

THE fossil remains of an immense crocodile have been found at the end of the Kansas Pacific Railroad. The entire length of the skeleton is 125 feet.

THE heart softened by the fire of affliction is like the iron when heated in the furnace; capable of receiving impressions and being fashioned at will.

LEATHER belts are frequently ruined by too much oil. It permeates and rots the leather, or burns it by the heat generated by friction.

MRS. SECRETARY McCULLOCH'S REPORT.

No Decline in Household Treasures.

Ten years ago I purchased a Wheeler & Wilson Sewing Machine, and have had it in constant use in my family since. We used it during the war to make clothing for our volunteers in the service, and for the hospitals, and this work was very heavy, being coarse woolen and cotton fabrics. It is still in good working order, nothing having been broken but a few needles.

You are welcome to use my name in your recommendations.
MRS. HUGH McCULLOCH,
Wife of Secretary of U. S. Treasury, Washington.
To Messrs. Wheeler & Wilson.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

BEAVER DAMS.—One of the agents in the construction department of the Union Pacific Railroad says, that in floating ties down the Laramie river, it becomes necessary to build dams to produce a flood in consequence of the low stage of the water, as is frequently done in the Oil Regions of Pennsylvania, to float the flat boats loaded with oil, and which saved our fleet on the Red River during the late war. After the men left their work at night beavers begun where they left off and carried it on in a very satisfactory manner. In two or three instances where breaks occurred, these industrious animals have repaired them in a single night, to the saving of hundreds of dollars to the contractor.

An armor has been made at Brown's Atlas Works, Sheffield, England which was, before rolling, 20 feet long, 4 feet broad, and 21 inches thick weighing 420 cwt. The final rolling reduced the thickness to 15 inches. Two hundred and fifty tons of coal were consumed, and the labor of 200 men required for its production.

Chicago is to have some new gas works to cost \$400,000 and consume 45,000 tons of coal per annum. The gas holder's capacity is 600,000.

The Boston and Maine Eastern Railroads have made arrangements with the Montreal Ocean Steamship Company, to transport merchandise brought from Europe in the steamers of that line, and landed at Portland, to Boston and any part of New England.

A vessel arrived at Cleveland, Ohio, last week bringing with her 821 tons of iron ore from Marquette, Mich., the largest cargo of iron ever yet received at that port.

A new line of steamers is to be established between Italy and New York. The vessels will run from Naples to New York, and vice versa, touching at Messina and Palermo.

The latest attempt to establish communication between passengers and guard, and guard and driver on English railroads, appears, from the *Engineer*, to be a series of tubes for whistling, speaking, and displaying signals. Its value is yet an unsolved problem.

The Bessemer Steel Works, at Troy, N. Y., burned on the 20th of October, and to be im