

If by any means whatever, by the employment of natural or artificial draft, we can urge the combustion of fuel and yet retain the heat or detain it from being driven off before it has given up its calorific power—if, I say, we can do this at a moderate cost, we shall obtain something approaching perfect combustion, and far greater economy than we have at present. A steam boiler furnace is in the nature of a retort for distilling the gases from the coal and applying them to the evaporation of water: but from its defective construction the gases are allowed to pass off without being ignited and the principal agents from which heat is derived are lost. In Siemens's furnace and in some others the gases are consumed in a combustion chamber, which is supplied with air when the gases are at a proper temperature to ignite, and great economy is the result. The same principle has been adopted in other ways, and the value of a given quantity of fuel noticeably enhanced. It has even been applied to cooking stoves with good results.

The efficiency of Roby's apparatus is in my opinion owing to the detention of the products of combustion in the flues (not in the smoke box as many do) until they are at the proper temperature to ignite. This view seems to me reasonable from the fact that the smoke is consumed. Smoke contains not only the watery vapor evolved from the incandescent fuel, but also pure carbon in the form of soot, which is nothing but unburned coal and is usually deposited along the surface of the tubes. In this boiler, however, no soot forms, for the simple reason that none is made: it is burned with the gases in the furnace before it is "born." I do not think that this apparatus would be universally successful in all cases, as the temperature at which the gases would ignite without escaping from the boiler would depend greatly on the length of the tubes and the diameter of them, also the velocity with which they passed through the tubes. The velocity could of course be regulated by the dampers, for such they are in effect.

Many years ago an apparatus similar to this was invented, having the same object in view. It consisted of a series of slats like a Venetian blind, hung in such a way that the exit of the gases was delayed, but I know nothing of its efficiency.

It would also seem that this boiler must be fired or run for some little while as an ordinary boiler before throwing the dampers into gear; so as to allow the tubes to get hot enough to perform the office which is demanded of them. The increased evaporation may also be simply owing to the retardation of heat in the boiler by the dampers, checking the flow, as it were, and compelling it to give up its virtue: but in this case, unless combustion were nearly perfect, the tubes would soon be stopped with soot. No doubt if air in jets were admitted to the flues the result would be still more satisfactory.

I have no doubt but we shall find in the future that multitubular boilers are imperfect both in point of expense and heating surface. If we can get the same amount of fire surface in another form, I do not see any good reasons for continuing to use many-flued boilers. They are always leaking, get clogged with soot unless anthracite is used, are in no wise efficient in proportion to the amount of heating surface exposed to the fire directly and of that most remote from it, and are always a source of anxiety.

I do not see any reason why a funnel turned bottom side up would not represent a plan for an economical steam boiler. In this case we should have enormous grate surface which would enable us to carry light fires instead of piling coal on a foot deep as is universally the case. We should then roast the gas out of the coal and burn it in the boiler, not at the top of the chimney as is now done; we should have large fire surface, plain in form, to which no soot could adhere, and if necessary we might fill the top with short flues that could be easily cleaned and repaired and in which there would not be 600 degrees difference in the heat at the ends, as is now found. I noticed a boiler of this general plan in a late number of the *London Engineer*, as built by Messrs. Shand & Mason: but this design was made by me and described to the Editor of this paper a long time before the engraving appeared. This form of boiler would not require to be so large for a given efficiency, I think, as a locomotive boiler, (though I do not assert this for I have made no calculation) and could be as readily braced as any other generator.

Economy of fuel is a question of the greatest importance, and it seems to me that appliances, such as cut-offs, are often mistaken for principles, though I do not wish to be thought hostile to working steam expansively in saying so. I am confident that we are on the eve of reform in this respect, and that where we at the best evaporate ten or twelve pounds of water for one pound of coal we shall increase the evaporation four fold.

EGBERT P. WATSON.

New York, Jan. 23, 1867.

VARYING IDEAS OF MODEL MAKERS.

In our last issue we spoke of model making as a business, and alluded to the beauty of which models are capable. It is singular to see what varying and sometimes crude ideas persons who attempt to ultimate their notions into visible forms have in relation to what constitutes a proper model. We have frequent opportunities to judge upon this subject. One of the most remarkable comparisons came under our observation a few days ago. One of the models was a simple household device, capable of being a working model if made no more than one inch square, yet it occupied almost as much room as an ordinary wheelbarrow, and was built in the most clumsy manner, of inch boards, fastened together with large nails, and betraying, in shape and workmanship, the clumsiest and crudest mechanical ability.

The other was a model of models. A grindstone for house-

hold and shop purposes, which could be secured temporarily to the edge of a bench or table, having its trough for water, its rest for the implement to be ground, and a scraper or detainer to prevent the water from escaping by centrifugal force. The stone was a real grindstone, and the frame was of brass, a perfect working model, complete in every part, yet weighing less than one ounce, and occupied less than a cubic inch of space. One was the effort of a man who either possessed small mechanical abilities or felt no pride in his handiwork, and the other was the product of a true mechanic.

Editorial Summary.

AMERICAN GREATNESS.—If the Yankees have acquired the name of great boasters they may be excused on the ground of having so much to be proud of, even in the natural features of their country. The greatest cave in the world is in Kentucky; the greatest river and the largest valley in the world are the Mississippi river and valley; the largest inland sea of the world is Lake Superior; the greatest mass of solid iron is the Iron Mountain of Missouri; the Falls of Niagara is the greatest cataract in the world; Chicago is the largest grain port and lumber market; New York has the largest aqueduct in the world, while Pennsylvania contains the largest deposits of anthracite, and Illinois the greatest extent of bituminous coal fields in the known world.

THE FIRST SUBAQUEOUS TUNNEL IN AMERICA.—Chicago, having made a good beginning, goes on tunnelling. The next work in order is a tunnel under the Chicago river, where it is crossed by Washington street, which will be 1,800 feet long, having two passage ways for trains, each eleven feet wide, with a third for general purposes. The masonry will be protected by a heavy sheathing of lead. Instead of boring under the bed from the ends in the usual way, this tunnel will be constructed by sections in coffer dams, taking up a portion of the river bed at a time, so as to obstruct navigation as little as possible. We see it stated that the contractors have agreed to complete the work in March, 1868, for \$271,646 04—mills, we suppose, not counted.

OUR WONDERFUL CLIMATE.—Here we are in the midst of what is conventionally called "winter," with roses blooming in the open air, strawberries ripening as in summer, orange trees in blossom where there are any orange trees at all, bouquets of open air violets selling at a bit on the streets, second crop apples that have just ripened exhibited in market, and grapes that have never suffered from contact with saw-dust, still plump, plentiful and cheap at all the fruit stands. Gardening to supply the city with early vegetables has actively commenced around the bay, and young radishes and green peas can even now be bought at luxurious prices. Winter! The word should be abolished from our vocabulary as a superfluity.—*San Francisco Bulletin*, Dec. 29th.

MERCURY IN HUMAN REMAINS.—A French journal relates a story of a wealthy farmer who died many years ago, and on digging a grave in close proximity to where he had been buried, the bones were accidentally exhumed. On examination brilliant particles of a metallic luster were found, which on being collected presented a considerable quantity of oxide of mercury. Thus for thirty-five years the mercury had been preserved almost without alteration in the body of the deceased who had probably made frequent use of the metal during the latter part of his life.

MORTALITY AMONG MINERS.—In the county of Redruth, England, which abounds in copper mines, it is stated that in every 100,000 of the population 220 males annually die of pulmonary diseases more than females. This is not so bad as in the lead-mining districts where the excess is 320 in every 100,000 and the death rate of men is double that of women. In the tin-mining districts of Penzance the superior waste of male over female life in the mining population of all ages is 104.

SUBTERRANEAN CITY RAILWAYS.—The London tunnel railway, with its enormous cost, from peculiar local conditions, of five and a half millions of dollars per mile, has paid from the start, five per cent in 1863, six and a half per cent in 1864, and seven per cent in 1865, which are considered very large returns for money invested in England. Over twenty millions of passengers were conveyed by it in 1866.

NATIVE SILVER.—The most celebrated silver mine in Europe is that of Königsberg, in Norway, which is 180 fathoms deep. In the Museum of Natural History at Copenhagen an enormous mass of native silver is on exhibition, taken from this mine, which measures six feet in length, two feet in width, and eight inches thick, and is estimated to contain five hundred pounds of pure silver.

PHOTOGRAPHERS who use large quantities of nitrate of silver should allow all the excess of silver acetic acid and other matters from the plates undergoing development to run into stone jars containing fragments of zinc. By this means the metallic silver may be collected, digested with dilute sulphuric acid, washed and dried in the oven, and thus by a little pains quite a large saving may result.

STREAKY WEATHER.—During the tremendous rain storm of December 20th in California, a curious exception is reported to have occurred at Fair Oaks, near Menlo Park, where for the greater part of the day little rain fell; men plowing in their shirt sleeves while torrents were falling at San Jose and Redwood City, on both sides. The rainfall at San Francisco was 7.16 inches in 20 hours nearly double the heaviest on record.

SMALL ARMS IN THE WAR.—A report by the Chief of Ordnance shows that the Springfield armory furnished 801,997 new rifled muskets, of calibre .58, for the suppression of the rebellion, average cost \$11.97; besides 670,617 of the same description purchased of American manufacturers at \$19.23 and 54,117 at \$28.15: 393,961 breech-loading carbines were purchased of American manufacturers at an average of \$22.73, and 359,449 revolvers at \$15.92, with 548 at \$6.10. Foreign arms: 428, 292 Enfield rifles, at \$20.07; 736,049 other muskets at \$13.66; 10,251 carbines at \$6.90; 12,374 revolvers at \$16.57. This foots up nearly three and a half millions (3,467,655) of small arms of all sorts and sizes.

STATIONARY-ENGINE PLOWING.—Mr. James Howard, the implement maker of Bedford, Eng., patents a mode of working two gangs of steam plows or cultivators by two stationary engines on opposite sides of a field. Each engine has two winding drums, one connected with each gang, by means of which each is drawn to the meeting point in the middle of the field by one of the engines, and then drawn back by the other engine while the other gang goes forward; all without shifting the connections.

A FRENCH FIRE ALARM, invented by M. Robert Houdin, the well known ex-conjuror, is set in operation by the action of a very slight degree of heat upon a thin metallic strip formed of a ribbon of copper and another of steel, soldered together by their flat surfaces. The copper expanding by warmth more than the steel, bends the strip so as to bring it in contact with a conductor and complete an electro-magnetic circuit, causing an alarm bell to ring continuously as long as the warmth is kept up.

EXTINGUISHING FIRES by the gaseous products of combustion, is an expedient which has been brought forward in England by Messrs. Dawson & Broadbent. They propose to connect buildings, by means of pipes similar to the gas system, or otherwise, with reservoirs of gas collected from furnaces and cooled, from which it can be driven by steam power into any apartment in which a fire may occur; thus displacing and shutting off the supply of oxygen by the energetic interposition of incombustible gases.

SALT ON CITY CAR TRACKS.—One who knows, a Philadelphia conductor, says that to protect his feet from cold when the tracks are salted, he is obliged to wear boots that are not only double-soled, but that have two thicknesses of upper leather, and over these a pair of extra thick fur-lined moccasins, and even then he suffers from extreme cold. The City Council has prohibited the use of salt in the streets.

THE ELECTRIC LIGHT has been used on a large scale in the construction of the Northern Railway of Spain, to enable work to be done by night during hot weather, as well as in tunnelling, where the absence of ordinary combustion and its products proved a great advantage. The entire expense involved in illuminating a space of 4,000 by 1,500 feet did not exceed, as reported, \$1.75 per hour.

FIVE SNOW STORMS have been experienced at New Orleans, in 87 years. In December, 1800, snow fell for the first time in twenty years. Snow again fell in 1817, and again on New Year day, 1822. The next snow storm was on February 8th, 1831, after which twenty-one years elapsed before the next snow storm occurred, in 1852. Since that period no snow has fallen in Louisiana.

A NEW COMPETITOR IN SUGAR.—The Sandwich Islands exported 3,005,603 pounds in 1862, and 5,262,112 pounds in 1863, and in 1864 the exportation almost doubled, having reached 10,414,441 pounds. New sugar plantations are constantly started, and the area of sugar land as yet untouched is very large.

THE GOLD AND SILVER PRODUCT.—The report of J. Ross Browne, Special Commissioner on the mineral resources of the States and Territories west of the Rocky Mountains, gives an estimate of the product for 1866 of gold and silver at \$106,000,000 from California, Montana, Idaho, Colorado, Nevada, Oregon and other sections.

GOLD MINING IN VERMONT.—Parties interested report that from four to six mills will probably be put up next season at Bridgewater, Vt., for reducing the quartz of that region, and that a yield of from \$15 to \$30 per ton is expected. Work has been going on constantly during the past season, and four or five new and promising openings have been made.

SKATING GIRLS.—A young lady of fifteen summers (not winters) skated one day this winter from Minneapolis to Dayton, 40 miles, in six hours. Another miss of the same age is performing fancy skating to the admiration of large assemblies in western cities.

BREECH-LOADING RIFLES.—About eighty a day of the new breech-loaders are now being turned out at the Springfield armory, and the number will be constantly increased until in February two hundred will be the daily production.

THE PRUSSIAN LEGISLATURE voted to Count Bismarck \$375,000, and to the war minister and five generals, 150,000 each, in acknowledgment of services in the late war. The presents were delivered on Christmas eve.

THE LONDON TELEGRAPH boasts a daily circulation of 138,704 copies—the largest daily newspaper circulation in the world.

HEAVY PUNCHING.—The patentees of the punched gun manufacture have punched a 10½ in. hole down through a steel ingot four feet high and weighing three tons.