THE

Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

☞ American and Mexican News Company, Mexico, are Agents for the SCIENTIFIC AMERICAN.

☞ Messrs. Trubner & Co., 60 Paternoster Row, London, are also Agents for the SCIENTIFIC AMERICAN.

☞ "The American News Company," Agents, 121 Nassau street, New York.

☞ Messrs. Sampson Low, Son & Co., Booksellers, 47 Ludgate Hill, London, England, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent on them will be promptly attended to.

VOL. XV., No. 19, [NEW SERIES.] *Twenty-first Year.*

NEW YORK, SATURDAY, NOV. 3, 1866.

Contents:

(Illustrated articles are marked with an asterisk.)

THE USE OF FUEL.—MANAGEMENT OF BITUMINOUS COAL.

In our last issue we published a few practical suggestions in relation to the management of fires of anthracite coal. We made the general statement that mineral coal was a condensed form of carbon, requiring a large amount of oxygen to produce perfect combustion.

Bituminous coal contains more of the resinous qualities of the vegetable matter from which all coal is derived, than anthracite. It is largely used for the production of illuminating gas, and, where it is employed for heating purposes, supersedes, in some measure, the use of other artificial lights in dwellings. In our own experience we have read, many an evening, by the light of a generously large grate filled with glowing coal. When a lump was placed upon the fire, for a time a volume of dense, black smoke would rush up the chimney, until the heart of the block was warmed by the persistency of the fiery mass below, when it would crack open, sometimes with a report, and send up blue and then bright yellow flames, illuminating the whole room. One thing was noticeable, and that was, that when such a fire was first kindled it would give out no appreciable heat. The energy of the fire seemed to be directed to overcoming the resistance of the fuel. The blue, gaseous flame was somewhat like the popular idea of the moon's light, without heat, yet this blue flame was a highly combustible gas, if it could have been retained long enough in contact with the heat to have mixed with sufficient oxygen. Its value as a fuel was lost by being forced up the chimney to the outer atmosphere.

In the burning of bituminous coal in open fires there should be first a proper grate. Almost all the grates used for this purpose, in dwellings and other buildings, for warming purposes, are too coarse. They allow the finer particles of coal to pass through and get lost in the ashes; or, these particles induce another fire below the grate and tend to melt it down rapidly. When bituminous coal is used in large lumps, much of its valuable carbon is wasted in the form of gas or black smoke, before it can be ignited and give out any heat. The coal should be fine enough to be easily heated and ignited. The sooner this is done the quicker is the fire, and the more the carbon of the coal is utilized. For this reason a finer grate than is generally used, and smaller coal than that commonly placed upon the fire, is an economical method of utilizing the greater portion of the carbon. The grates now in use can be readily changed to effect this saving by placing a sheet of iron, closely perforated with small holes, upon the inside of the grate bars. We have tried this plan with excellent results.

These remarks are not of universal application; for there are several varieties of bituminous coal, some so nearly approaching pure bitumen as to melt in mass and cake, refusing to be separated permanently until well coked. This sort would require a more open grate or an admixture of coke to make it burn freely. Coke is the residuum of bituminous coals, from which the volatile portions have been driven off, in the form of gas, by heat. It is measurably pure carbon, and of so porous a structure as to readily admit the passage of the atmospheric air through the mass.

The philosophy of blowing a fire is simply forcing a larger relative amount of oxygen into connection with the carbon than the ordinary draft would furnish. It acts, also, in a mechanical way, by driving off the products of combustion, the principal of which, carbonic acid gas, is as inimical to a clear fire as to animal life.

The proper management of a fire then, consists in furnishing oxygen in quantities sufficient to burn all the carbon. A good draft is necessary, and the coal should be fed upon the fire in small quantities. If a dense, black smoke is the result of replenishing the fire, some of the most valuable parts of the carbon are carried, unconsumed, up the chimney and entirely lost. The fire should be kept always bright and it will, to a great extent, consume its own gases before they can escape. As in anthracite, so in bituminous coal, the remains of the fire are valuable. The unconsumed coal is more or less coked and will more readily ignite than the green coal. None of this should be wasted.

A little attention to the management of fires in our dwellings, by those who understand the philosophy of combustion, would result in a large annual saving. Even the most ignorant servant can be readily taught how to regulate the supply of fuel and air by a few simple directions, whether the science of fire and fuel is understood or not. It should always be remembered that the pure white or yellow flame is that which yields the heat. Dark smoke and blue gases are not the results sought for in burning fuel.

BOILER EXPLOSIONS NOT ALWAYS MYSTERIOUS.

At intervals, recurring with terrible frequency, the readers of our public journals are startled and shocked—if familiarity has not induced callousness—by accounts of steam boiler explosions, attended always with loss of property, and often with loss of life or limb.

To no other subject is the old adage, "in too much discussion the truth is lost," more applicable than to that of boiler explosions. The cause of these catastrophes has been so muddled by wordy dissertations, mysterious theories, and senseless conjectures, that few think of looking directly at the facts of each individual case and deciding each on its own evidence. Mysterious agencies, under the names of "contraction," "expansion," "electricity," "development of explosive gases," and others, figure conspicuously in the reports of committees of inquiry. The causes which are most obvious, or could be most easily ascertained, are overlooked, and the investigators go prowling about among unknown or not understood forces, to find that which frequently is before their eyes. Braces originally too weak, corroded, or improperly located; plates running longitudinally instead of circumferentially; defective riveting; plates weakened by large holes not filled with the rivets; deficiency in the thickness of plate; poor iron, and carelessness in calking, are overlooked, to say nothing of corrosion from impure water, hard firing, or neglected water feed, and incompetent attendants.

Sometimes, in riveting, the holes in the plates diverge half their diameter, and they are reamed to a circular form, or enough to admit the ordinary rivet, which cannot fill the space, and depends for its security wholly on the juxtaposition of the heads with the surface of the plates. Heat expands the iron, loosening the rivets, the water works through, and, if containing salts, rapidly oxidizes the iron, opening the way for a rupture. The careless use of the calking chisel sometimes cuts into the plate one-third or one-fourth of its thickness, so that when an explosion occurs the line of the fracture follows the channel thus made, as the breaking of glass follows the diamond scratch.

In connection with these remarks we cannot help referring to an accident on a fine steamer only a few months ago, by which a number of persons lost their lives. An investigation was had before the coroner's jury, which resulted in a perfect mystification. Yet the cause or causes should have been apparent in several facts which were ascertained. First, that part of the boiler that gave way was so deficient in substance that, at the maximum working pressure, the iron was strained to nearly its rupturing limit; the factor of safety, instead of being 5 or 6, being hardly above 0. Second, the sheets, instead of being placed circumferentially so that the joints would not be so long in the direction of the length of the cylinder, and so that each would support the adjacent ones, were placed with the long diameter running lengthwise. Third, the calking iron had injured the iron along the seams nearly 20 per cent, and the braces were placed in an improper manner.

It can scarcely be contended that this was an exceptional case. It is to be feared that many of our boilers would not stand a thorough scrutiny on these points. Mr. Edward B. Martin, an eminent engineer of Stourbridge, England, recently read before the Institution of Mechanical Engineers a paper which exhibited the following facts:—During the present century there have been 1,045 boiler explosions in England, causing the death of 4,076 persons and injuries to 2,903. Of the 1,045 explosions, 397 were "uncertain" as to cause; 137 were from over-pressure, from the wedging or over-weighting of safety valves, or from other acts of carelessness; 119 from collapse of internal flues; 114 from shortness of water, or from incrustations, and 9 from extraneous causes not immediately connected with the boiler. From these facts Mr. Martin expressed himself as opposed to all ideas of internal detonation, spontaneous generation of explosive gases, or other mysteries.

If this is approximately a correct exhibit of the causes of boiler explosions in England, need we look for some mysterious and unknown agency to account for similar occurrences here? It is well known that English mechanics and engineers are held to strict accountability by the laws, much more so than in this country. It may be claimed that the tenacity of American boiler plate is superior, and such extreme caution as is enforced in England is unnecessary here; but in this matter as in others it is "better to be foolishly careful than foolishly careless."

We believe that a rigid examination of boilers and a thorough oversight and testing during the process of manufacture, as well as after completion, enforced by legislative penalties, would prevent some, at least, of the destructive explosions we are too often called upon to deplore.

A Uniform Money Standard.

France, Italy, Switzerland, and Belgium have recently entered into a convention to regulate the currency of their respective governments, and bring it to a uniform standard of weight, value, and form. They agree not to coin, nor allow to be coined, bearing their impressions and designs, gold money in any other forms than those of gold pieces of 100f. 50f., 20f., 10f., and 5f., fixed as to weight, values, allowances for loss, and diameter according to a certain scale. A fixed regulation allows for wear and loss. The convention also fixes the denominations, values, sizes, etc., of silver coins, and also restricts the amount to be coined by each country to a certain proportion to their respective populations.

This may be regarded as a step of very great importance in commerce. Its effect on the social improvement of the people and civilization generally will be very marked. To make the change more effective, the United States and England should join the convention, which would ultimately compel the co-operation of every European nation. The distinctive legends of each nation will, of course, be retained on their coins, but the values of the coins would be identical with those of similar denomina-