Some Facts about Diamonds.

From Dr. Feuchtwanger's treatise on gems we take the following statements in reference to the diamond:—

"A letter was lately published from Sir David Brewster, on a curious optical phenomenon that had occurred in the construction of a diagonal lens. The diamond, previous to working, had all the appearance of internal brilliancy; but, after being polished, it presented a series of stratified shades, which rendered it useless for the required purpose. It afterwards appeared that lapidaries were acquainted with this appearance, which rendered them extremely unwilling to take the risk on themselves, of cutting up diamonds for optical purposes. On a minute examination of this phenomenon, it appeared that these different shades occurred in regular strata, each section being about the one-hundredth part of an inch, and each stratum having a different focus, and being of a different degree of hardness and specific gravity. The inferences drawn from the above facts were—that the diamond was a vegetable substance, and that its parts must have been held in solution and subjected to different degrees of pressure at different stages of existence. If, on the contrary, as it has been generally believed, it is subject to the laws of crystallization, its crystals must necessarily be homogeneous.

"The diamond being the hardest of all substances, yields to no file; scratches all other minerals, and is not touched by any. This character has become the most important of the diamond since the late discovery of the amorphous or compact diamond. It is very frequently tinged light-green, but more rarely with orange, red, blue, or black; but in setting, these shades disappear, particularly in the smaller diamonds; but there are also known diamonds of rose and pistachio-nut green colors. The blue color is very rare. The blue diamond of Mr. Hope of London, is one of extreme beauty and rarity, and is of immense value; the yellow diamond in the Museum of Natural History, in Paris, is likewise very remarkable for its color and size. The black diamond, which is perfectly black, although plainly crystallized, occurs most frequently in small bristled balls, but crystalline points: the crystals are very small grouped together in an irregular manner, and extremely refractory to the cut; it is considered the hardest of all diamonds. The green diamond is also very rare, but I have seen some beautiful specimens in the Jardin des Plantes and in Freiberg, the first in the cabinet of Abbe Hauy, and the latter in the cabinet of Werner.

"In Russia, the first diamond was discovered in July, 1829, by Humboldt and Rose, when on their journey to Siberia, on the west side of the Uralian mountains, in the gold-washing establishments of Krestowosdwisheaski, belonging to Count Schuwalow. The locality, in connection with the other circumstances of the place where the diamond was found, bears a striking resemblance to the diamond district of Brazil. The predominating rock of the spot on the Uralian mountains is a quartzose chlorite, talcose schist (itacolumite), with an admixture of iron pyrites and mica, wherein we find beds of red oxide of iron, talcose schist, limestone, and dolomite.

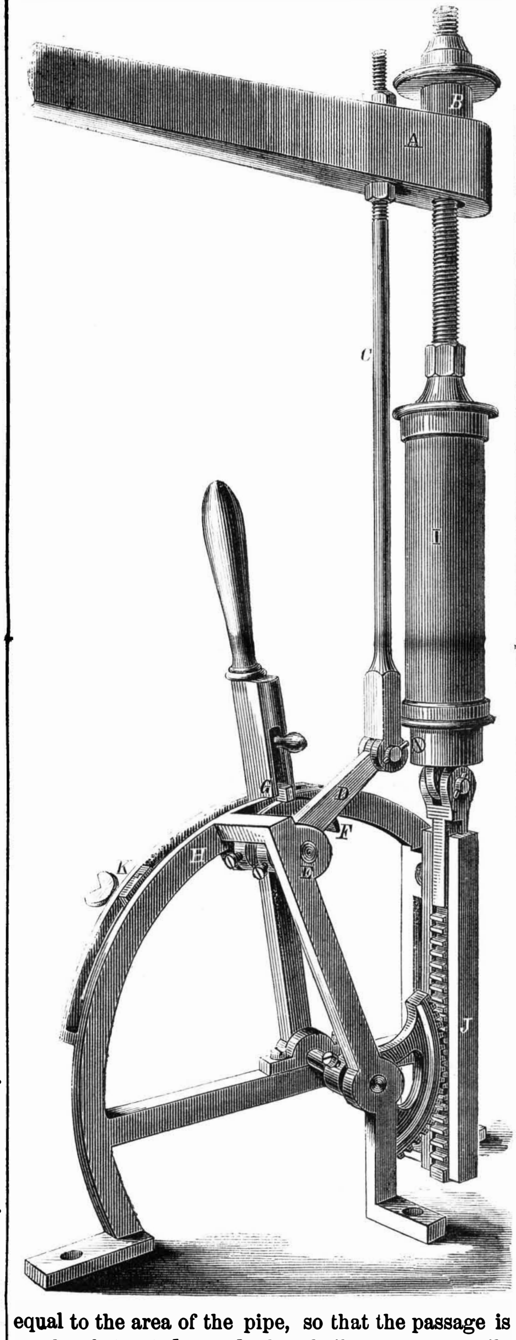
"At a most extensive sale of diamonds, which took place in the summer of 1837, at the auction of Rundell & Bridges, London, there were twenty-four lots put up, which produced the sum of forty-five thousand eight hundred and eighteen pounds, nearly two hundred and twenty-nine thousand dollars! Some of the prices were as follows:—The celebrated Nassak diamond, which weighs three hundred and fifty-seven and a half grains, and is of the purest water, was purchased for thirty-six thousand dollars. It is considered to have been sold at a price considerably under its value. A magnificent pair of brilliant ear-rings, weighing two hundred twenty-three and a half grains, formerly the property of Queen Charlotte, were bought for fifty-five thousand dollars, a price infinitely below their usually estimated value. A sapphire, seventy-five and a half carets, set with brilliants for a brooch, two thousand four hundr'd and sixty-five dollars.

"According to Spix and Martius, there have been produced in Brazil, from 1772 to 1818, 1,298,037 carats of diamonds—that is, in the time of the Royal Administration; but that during the Lease, only 1,700,000 carats were produced, which together make 2,998,037 carats, or 1301¼ pounds, thus averaging from fourteen to fifteen pounds per year; those brought into market by contraband being excepted.

"The largest diamond is in the possession of the Grand Mogul, and according to Tavernier, resembles in form and size, half a hen's egg. Its weight is two hundred and ninety-seven and three-sixteenths carats. It was found in 1552, in the mine of Colore, a short distance to the east of Golconda, and is valued at 11,723,000 francs. It is cut as a rose-diamond, and is perfectly limpid, with the exception of a small flaw at the end of the girdle."

HUNTINGTON'S SELF-ACTING SAFETY-VALVE.

When a safety-valve rises to let off steam it does so gradually and gently, and as the pressure increases it continues rising until it can go no further. In many cases the distance to which the valve lifts is not



equal to the area of the pipe, so that the passage is much obstructed, and the boiler unnecessarily strained in consequence. The machine shown herewith is designed to obviate this evil, and to permit the steam to blow off as fast as it is formed. It is self-acting, and requires no attention; when it is once set the engineer may leave the cab and go to his dinner in perfect confidence that the valve will unhook itself at the proper time if the pressure becomes too great. No slacking off of the spring balances is required with this arrangement, as a single motion of the lever throws the balances up so that they are relieved from strain.

In the engraving the front of the spring balance is toward the engineer, as usual, and the safety-valve lever, A, is shown running from it to the dome. The rod of the spring balance passes through this lever and has a nut, B, on top to regulate the pressure.

There is an additional rod, C, which passes through the lever and connects to an arm, D, on the shaft, E. This rod trips the valve-lever, A, through the medium of the toe, F.

It will be seen that as the valve lifts, the small rod is drawn up, so that by degrees the toe, F, rises against the stop, G, which sets in a slot in the quadrant, H. When it has raised far enough to trip the toe or throw the stop, G, out of its seat, the lever, A, flies up immediately and quickly enlarges the area of the safety-valve passage. The spring balance is only held down by the rack and sector, J, and these in turn are held by the shallow recess in the quadrant, H, so that when the stop is pushed out by the toe, F, the lever goes up instantly, as before described. The check piece, K, limits the distance to which the valve lever rises, and it may be set at any point desired.

This invention was patented through the Scientific American Patent Agency, February 9th, 1864. For further information address Wm. S. Huntington, Andrusville, N. Y.

THE CALORIMETER OF BOILERS.

It is always well that terms should be exactly understood. The word "calorimeter" is so strictly technical that many of our readers might possibly be at a loss to comprehend its meaning without some definition. The calorimeter of a boiler, then, is simply the area of the orifice or orifices of its flue tube or tubes, and the proportion which this bears to the area of the interstices of the fire grate exerts a very important influence on the economical and positive efficiency of every steam generator. It is a pity that this fact has hitherto been very much over looked. It is too much the custom to construct boilers with the largest possible amount of tube surface, under the idea that thereby heat which would otherwise be wasted is saved up and converted to a useful purpose. The fact is, that the generation of caloric by combustion is one thing, and its subsequent use quite another; and, as we have before endeavored to show, the value of heating surface depends on a great many conditions, independently of its mere extension. Thus, boilers with crowded tubes cannot steam well because the contact of the water with the metal surfaces is prevented by films of that steam which cannot disentangle itself from the water with sufficient rapidity for want of room. There is in such boilers a want of circulation, and the result is that the tubes are burned out.

It is well understood now that very small and long tubes are inefficient. Stephenson's long boiler locomotive could not make steam without such a contracted blast-pipe that all the saving due to the reduction of temperature in the smoke-box was re-absorbed by back pressure in the cylinders. The locality of the waste was changed; its amount remained unaltered. The larger a flue tube is within certain limits the better; but if it is attempted to keep up the superficial area of heating surface by increasing their number, it is certain that the calorimeter must be injuriously increased in a nearly equal proportion; and it follows that a boiler with a few tubes of moderate diameter will be actually more efficient and more economical than one with either a greater number of tubes of equal diameter, or another with a larger number of tubes of small diameter, although the calorimeter is thereby in some degree kept within proper limits; and this is especially true of coal-burning engines. This statement may appear paradoxical; it is not the less true. In the first place, large tubes, from reasons which we pointed out in a recent article, permit a certain amount of combustion to go on within them. This cannot take place in very small tubes. The value of any heating surface increases in a very rapid ratio with the intensity of the heat to which it is exposed, and it follows that, as very small tubes cannot be traversed by flame, or even by very highly heated air—most of the caloric being given up in the first foot of length—they must be inferior inch for inch to those of fair dimensions, say three inches in diameter. If to this we add the loss due to contracted water-way, and the absence of circulation, it is easy to see that a limit is quickly reached beyond which no advantage whatever can be derived from the extension of tube surface. The worst defect of all, however, consequent on the presence of too many tubes, large or small, is found in the increase of the calorimeter, which is the real measure in all practical boilers—or, if not, it should be—of the quantity of air passing through the burning fuel. The great secret of success in boiler engineering is involved in the admission of just air enough, and no more, to complete the combustion of the fuel upon the grate. The temperature of a furnace is the measure of its economic evaporative efficiency, and this depends solely on the quantity of air which passes through it in a given time. For instance, with the best hard coke the temperature produced by just sufficient air to completely oxidize it will be about 4·347° Fah. If twice this quantity of air is admitted, the resulting temperature will be only 2·347°, and the evaporative value of the heat in the first case will be perhaps three times that produced in the second case, although the rate of combustion may be in both cases equal, or nearly so, and consequently the entire quantity of caloric expended precisely the same. A practical illustration of this fact is given every time a fire-door is opened to check the production of steam. A two-fold action ensues. The rapidity of combustion is moderately reduced at once, while the air rushing in absorbs so much heat from the fuel that very little remains to be imparted to the boiler. It is a mistake to imagine that the flues are absolutely cooled down. Their maximum temperature can only at most, be a very few degrees above that corresponding to the existing pressure within the boiler; and yet is certain that the heat of the entering air must, by the time it reaches the flues, be greatly in excess of this. The cooling action is indirect, not direct; and it implies a reduction in the quantity of caloric poured into the water, not a reabsorption of that already there. Indeed, it is possible that the temperature within the tubes is but moderately lower, in the few minutes after the door is opened, than it was before. But from what we have already said on the value of intensity, it will be easily understood that a very moderate reduction in this element will produce a very considerable reduction in the quantity of steam produced in a given time.

The most valuable experiments ever conducted on the relation of the calorimeter to the efficiency of a boiler were undertaken and carried out by Chief Engineer Isherwood, of the United States' Navy. We have before now taken exception to his views on expansion, and nothing has occurred since to lead us to form different opinions; but there can be no doubt that Mr. Isherwood is a careful experimenter, and all that he states is, therefore entitled to due consideration. In order, then, to settle this question, he selected a boiler of the ordinary return flue marine type, driving the machine shop of the New York navy yard. This boiler is 12 feet long, 7 feet 6 inches wide, and 12 feet high without a steam dome; the furnaces are two in number, 6 feet by 3 feet; the crowns 22 inches above the bars in front and 28 inches at the bridge. The lining plate of each furnace door is perforated with 100 3-8th-inch holes, on Williams's principle. The tubes are 144 in number, 3 inches diameter outside, and 8 feet 3 inches long. They are nine rows in hight, occupying a vertical space of 37 inches. The experiments were made by stopping up certain tubes with iron plugs; the fuel used was anthracite, and the results obtained were as follows:—

	Rate of combustion.	Area of heating surface.	Economic efficiency.
With all the tubes in use........	1·000	100·00	1·000
With the 2 upper horizontal rows stopped................	1·142	83·24	1·069
With the 3 upper rows stopped.	0.840	74'87	1·168
With the 4 upper rows stopped.	0·891	66·48	1·192
With the 2 lower rows stopped.	0·868	83·24	0·924
With the 3 lower rows stopped..	0·955	74·87	1·000
With the 4 lower rows stopped..	0·923	66·48	1·030
With the inner 2 vertical rows of each boiler stopped..........	0·874	81·15	0·930
With the inner 3 rows stopped..	0·990	71·72	0·965
With the inner 4 rows stopped..	0·951	62·29	0 990

Now two remarkable facts may be gleaned from this table. The first is, that, with the exception of the experiments with two rows of tubes suppressed, when the economic evaporation fell off 3 per cent, the economic evaporative efficiency increased a little with each diminution of tube surface and calorimeter, until, when four rows were stopped up, it had actually increased by 6¼ per cent over that obtained when all the tubes were in use. The second fact is that the tube area bore very little relation to the quantity of fuel burned. The extremes never varied more than 8 per cent. Here, then, we have a boiler the actual as well as the economic efficiency of which increased in a certain ratio as its heating surface was diminished. To what is this to be attributed? Simply to the fact that the calorimeter of all the tubes was so great that a much larger quantity of air than that indispensable for effecting combustion found its way into the fire-boxes, lowering the temperature, and consequently reducing the value of the fire-box surface. Closing an ash-pit damper would have had no effect; the rate of combustion would have been made less, but the proportion which the whole quantity of caloric produced would then bear to the number of cubic feet of air admitted would remain unaltered. In point of fact too much air through a grate is very nearly as fatal to the powers of a boiler as its admission through the fire door. The object had in view is the raising of water to a certain temperature, and its conversion into steam, and every cubic foot of air which enters a furnace above that necessary for complete combustion, carries away a portion of this heat to the chimney. There never was a more erroneous notion than the belief that advantage can be gained from filling a boiler and its tubes with a large volume of moderately heated air; one-half the quantity at a higher temperature would be more than twice as efficient.

We are not, however, to fall into an opposite error and reduce superficial tube area very much in order to keep down the calorimeter. A large tube with a contracted orifice is apparently, but only apparently, the proper thing. Thick ferrules, however, operate injuriously. They permit the existence of a languid current of air at the side of the tube, whether they are driven at the smoke-box or fire-box end. The best means of procuring a small calorimeter and a large tube surface will be found in the use of taper tubes, large at the fire-box end. At the present moment such tubes would be very expensive at first, though we feel no doubt that they would pay for themselves where coal is dear in a very short time. Improvements, however, are daily taking place in this branch of manufacture, and were there but a fair demand, there would soon be a full supply of tapered tubes in the market. It is more than probable that their use would be the greatest improvement of which the tubular boiler is now susceptible.—*London Mechanics' Magazine.*

[The term calorimeter would from its etymology manifestly mean a measurer of heat. It was applied by Lavoisier and Laplace to an instrument employed by them to determine the specific heat of different substances. We should suppose that the area of the orifices of the flue tubes would be a very uncertain indication of the heating capacity of a steam boiler, and therefore that the term "calorimeter" was not a happy selection of a name for this area.—EDS. SCI. AM.

The Iron Business of Lake Superior.

The amount of iron ore shipped from Lake Superior in 1855 was 1,447 tuns against 116,998 tuns in 1860, and 185,557 tuns in 1863. These amounts, especially those for the last two years, fall far below the demand, the difficulty having been in procuring transportation for the ore, and men to mine it. The quantity actually spoken for to supply the various furnaces using this ore, before the opening of navigation in 1862, was over 140,000 tuns, while in 1863, 250.000 tuns would not have supplied the demand.

Large investments have been made in timbered lands, along the lines of the Marquette and Ontonagon, and Peninsula Railroads, as well as on Big Bay de Noquet, with a view to erect blast furnaces for the manufacture of charcoal pig iron. The average value at Marquette of the ore shipped during the past year was $5 per tun, and that of the pig iron produced $45 per tun, giving the aggregate value of the iron product of the country for 1863, $1,327,245,-245.—*Marquette Journal.*

What Fifteen-inch Shot Do.

A correspondent of the New Orleans *Era* says:—

Troops continue to arrive, and the *Connecticut*, a few days ago brought down four hundred sailors from the North which has filled up all our deficiencies, and enables us to effectually man the *Tennessee* aud *Selma*, both of which vessels are doing very excellent service, the former at the fort and the latter about the bay in the shoal places. It must be very galling to the rebs to see the pride of their navy thus used against them. She went in at them last Saturday afternoon, and the fire from both was terrific. The fort struck her nine times but "failed beautifully" of producing any effect beyond the shooting away of a flagstaff, an anchor and a few fathoms of Chain. But the effect of our 15 and 11-inch shot is truly surprising. The after part of the monster's shield being all strained and shattered, and the angle on the port side aft completely opened apart. They are painting her new smoke-stack and touching her all around, slushing her down, &c.

DUST ON RAILROADS.

There is no necessity for having any dust in railroad traveling. In all parts of Europe, after a ride by rail the traveler does not need to have his coat brushed; the dust is effectually kept down by simply allowing grass to grow over the road. In this country men are employed to dig up every blade of grass and every weed that makes its appearance. The consequence is such a cloud of dust as to make railroad traveling a dreaded martyrdom, instead of a pleasant recreation as it is in other parts of the world.

The New York Central, and the New York and Erie roads are competing lines, and they both spend a good deal of money in advertisements and runners to draw business from each other. If the managers of one of these roads would cover the track with turf, or encourage the growth of grass they would most assuredly secure the monopoly of the through travel. Even roads where there is no competition, we have no doubt would find it to their advantage to adopt this effectual method for abolishing the one insufferable discomfort incident to this mode of locomotion.

The cheapest plan for covering a track with grass would doubtless be to spread manure over it, and sow hayseed. It would perhaps be well to sow rye also, or some other grain, together with the hayseed. This is the right time of year for the operation. Which one of the superintendents will win the blessings of the nation by taking the lead in this invaluable reform?

Cast Cast-steel Car Wheels.

In our list of Patents in the present number will be found that of Charles W. Stafford, Esq., of Saybrook, Conn., for process for *casting* a cast-steel car wheel.

This is a desideratum long sought for, and has heretofore failed of attainment. By the process just patented by Mr. Stafford the wheels are produced directly from molten cast-steel with great certainty and facility and in any of the ordinary forms which may be desirable. The hollow or cavity of the wheel is also susceptible of any variety of form which may be required, and has a smooth and perfect surface.

The great advantages of a cast-steel over a cast-iron car wheel are obvious to the most casual observer. The strength of cast-steel as compared with cast-iron is laid down as being from 5 or 6 to 1. The use of these wheels would afford almost an absolute insurance against all that class of accidents and the consequent damage resulting from broken wheels. Their value will be very great in all cases where a high rate of speed is sought, and also for burden trains on such roads as the Atlantic and Great Western, when it is desired to make long runs without change. The manufacture of cast-steel is in its infancy in this country, and we deem Mr. Stafford's invention a very important step in the right direction.

COLD ROLLING IRON.—Interesting experiments have been made with the process of cold rolling as applied to iron. In one case, on testing specimens of cold rolled iron, a black bar from the rails broke with 26,-173 tuns per square inch, a similar turned bar with 27,119 tuns, and a cold rolled bar of the same iron sustained 39,388 tuns. The elongations, which may be considered as the measure of ductility, were 200 and 220 per unit of strength in the case of ordinary iron, and .079 in the case of the cold rolled iron. A plate of cold rolled iron sustained no less than 51.3 tuns per square inch. Endeavors are being made to apply this invention to railway bars.

MEANS OF HARDENING FRAGILE OR FRIABLE SPECIMENS.—Mr. Stahl gives solidity to friable specimens, even if of loose material like a mold in sand of a shell or bone, by running in a mixture of resin and spermaceti melted together.—*Les Mondes.*