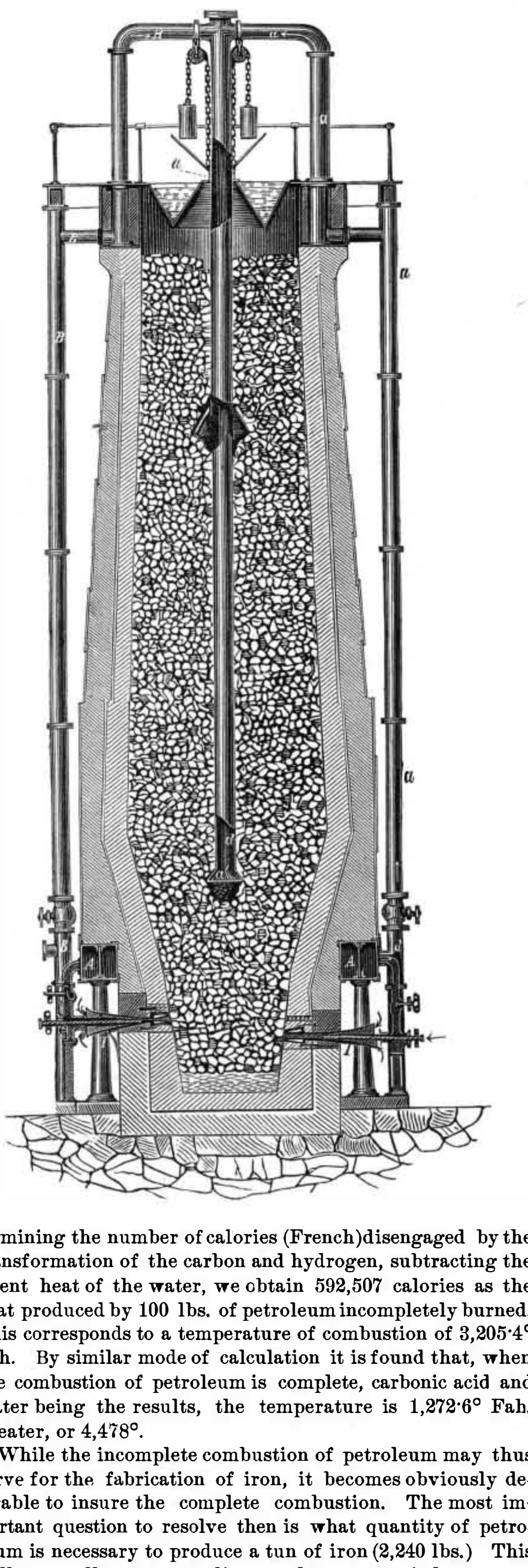
THE UTILIZATION OF PETROLEUM AND NATURAL GAS IN BLAST FURNACES.

The siderurgical value of petroleum depends greatly on its composition, and necessarily varies therewith. According to an analysis made by Professor Wurtz and published in the *Moniteur Industriel Belge* (from which journal we translate and condense the following), the composition of crude petroleum is: Carbon 84, hydrogen 14, oxygen 2—100. Or supposing that the 2 per cent of oxygen is combined with the hydrogen: Carbon 84, hydrogen 13·75, water 2·25—100. If the petroleum be incompletely burned, so that the carbon is transformed into the oxide and hydrogen into water, the siderurgical value of the petroleum may be calculated as follows: 34 lbs. of carbon require 112 lbs. of oxygen to effect the formation of carbonic oxide, and 112 lbs. of oxygen correspond to 4,306 lbs. of atmospheric air, the latter being considered to contain 26 per cent of oxygen. The products of combustion will then be formed of 196 lbs. of oxide of carbon, 126 lbs. of water, and 631·75 lbs. of nitrogen. Determining the number of calories (French) disengaged by the transformation of the carbon and hydrogen, subtracting the latent heat of the water, we obtain 592,507 calories as the heat produced by 100 lbs. of petroleum incompletely burned. This corresponds to a temperature of combustion of 3,205·4° Fah. By similar mode of calculation it is found that, when the combustion of petroleum is complete, carbonic acid and water being the results, the temperature is 1,272·6° Fah. greater, or 4,478°.



While the incomplete combustion of petroleum may thus serve for the fabrication of iron, it becomes obviously desirable to insure the complete combustion. The most important question to resolve then is what quantity of petroleum is necessary to produce a tun of iron (2,240 lbs.) This will naturally vary according to the nature of the ore employed. In the northwestern part of Pennsylvania, the cold blast furnaces absorb about 90 bushels of Connersville coke, containing 3,260 lbs. of carbon, to produce a tun of iron with magnetic oxides (or about 1·43 tuns of coke to 1 tun of iron). The ore necessary to produce 1 tun of iron contains 853 lbs. of oxygen, which require 640 lbs. of carbon to effect transformation into carbonic oxide. With these data the author finds that the consumption of petroleum per tun of iron is, for reduction, 256 lbs.; separation of the oxygen from the metal, 239 lbs.; fusion, waste, etc., 157 lbs. Total, 652 lbs., or about 97·5 gallons. He also makes similar calculations with regard to natural gas, such as is derived from the wells in Pennsylvania, Ohio, and elsewhere. The composition of this gas may be considered as carbon 64·01, hydrogen 21·31, water 0·26, nitrogen 4·31, carbonic acid 10·11—100. Considering first complete combustion, developing carbonic acid, the calorific value of gas per 100 lbs. is fixed at 1,136,561 calories, corresponding to the temperature of 4,262° Fah. Incomplete combustion producing carbonic oxide gives a calorific value per 100 lbs. of gas of 773,048, or the temperature of 3,275·6° Fah.

It has been proposed to practically utilize petroleum in blast furnaces by vaperizing it by means of superheated steam and then introducing it into the combustion zone with the blast. Thus employed, however, the hydrocarbon is but incompletely consumed, and the temperature practically gained is not sufficient to insure the advantageous working of the furnace.

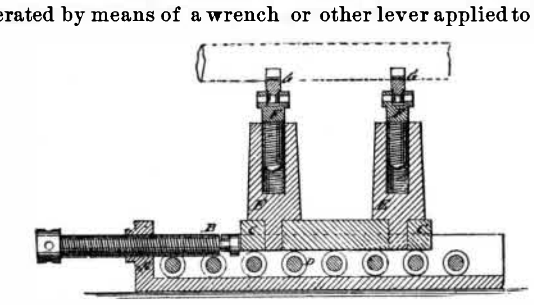
To avoid this difficulty the author, Mr. Charles Plagge, has devised a new apparatus whereby the influx of petroleum is divided, so that there is led into the combustion zone only that portion necessary to meet the reduced iron and the scoriæ; while the remainder of the petroleum, which roasts, reduces, and carbonizes the metal, is conducted into the upper or reducing zone of the furnace. The annexed engraving is a section of this device. The petroleum and the blast necessary for roasting are led by a central tube, which plunges into the reduction zone to a depth determined by experiment. In order to protect this tube from the heat, it is enveloped in a larger tube. There is thus formed an annular chamber for the circulation of hot and cold air, which enters from above and leaves the outer tube by special apertures, to pass into the furnace a little below the upper surface of the charge, a hight at which the petroleum enters the reducing zone. This air serves, in addition to preserving the tube, to burn all the gases and vapors, arising from the oil, which have not been utilized by the reduction and the fusion of the iron. The free oxygen, which enters the furnace above the zone of reduction, oxidizes the injurious impurities contained (sulphur, phosphorus, etc.); and the heat produced contributes in expelling the carbonic acid and combined water of the ore, and to heat the latter before its entrance into the reducing zone.

The author claims that by this means more iron can be produced daily, owing to the large quantity of ore with which furnaces can be charged through the absence of solid fuel, and also that the metal produced is of greater purity, owing to the elimination of impurities, as above noted, before it enters the reduction zone. The metal reduced at low temperature cannot be injured by deleterious matters in its passage from the zone of reduction to that of fusion, since it encounters only neutral gases, but very slightly oxidizing or reducing in nature, and since it is submitted to the purifying action of carbonic acid, which transforms into sulphurous, silicic, and phosphorous acids the small particles of sulphur, silicon, and phosphorus which the reduced metal may have absorbed.

A NEW COMPOUND ENGINE JACK.

When locomotive engines run off the track, it is a matter of much labor and difficulty to replace them. Raising the heavy weight vertically presents no especial obstacle, but to move it sideways requires much more labor and mechanical skill. Messrs. William C. Taylor and Rudolph Vampill, of Mullins, S. C., have patented, June 6, 1876, through the Scientific American Patent Agency, an ingenious improvement in compound engine jacks, by means of which an engine may be raised vertically, and then moved laterally to place it upon the rails.

In the annexed engraving, A is a cast iron box, open at the top and at one end, and in the closed end of which is formed a screw hole to receive a screw, B. The screw, B, is operated by means of a wrench or other lever applied to its



outer end. The forward end of the screw is swiveled to the end of the iron block, so that the said block, C, may be moved back and forth by turning the screw. The block, C, or its lower part, fits into the box, B, and rests upon the rollers, D, placed within said box, so that it may be moved easily, even when supporting a great weight. Into the upper side of the block, C, near its ends, are attached two posts, E, the upper parts of which are perforated longitudinally with screw holes, into which enter screws, F, which are turned by a wrench. To the upper ends of these are swivelled cross heads, G, having half-round notches formed in their upper sides. Several posts, E, of different lengths are provided to avoid the necessity of blocking up the jack.

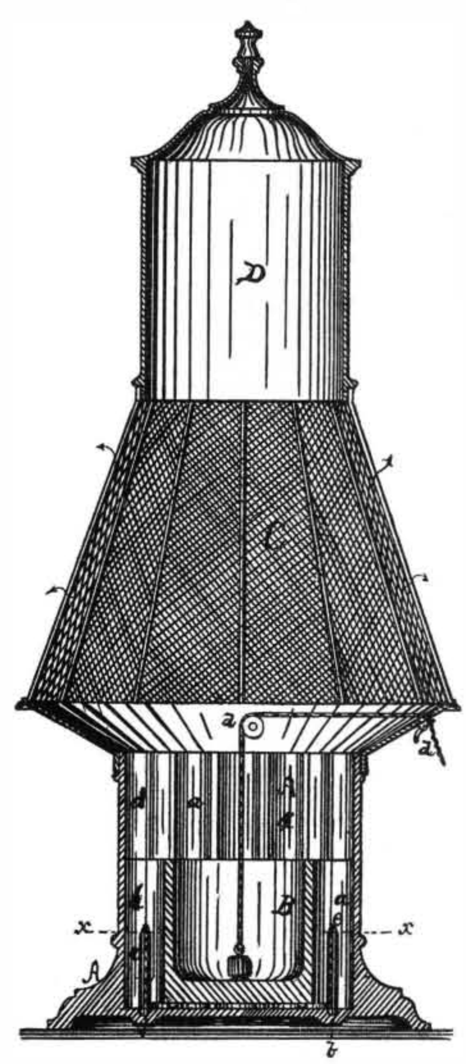
In using the device, it is placed beneath and parallel with the drive axle of the engine; and the screws, F, are turned up until the heads, G, come in contact with the drive axle and raise it enough to let the wheels pass over the rails. The screw, B, is then turned, moving the engine laterally, until the wheels are over the rails. The screws, F, are then turned down, lowering the said wheels upon the rails.

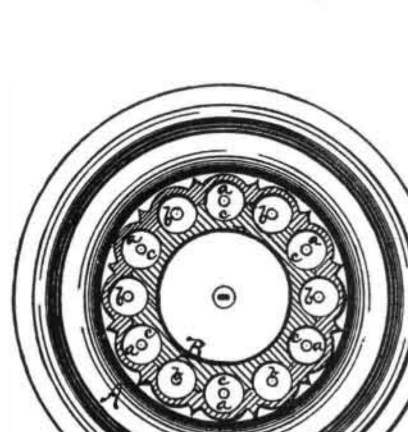
The Washington Monument.

There is a probability that the unsightly pile of stone called the Washington monument, in the national capital, will soon be pushed forward to completion. It is now 174 feet high. The amount required to carry it up to 485 feet and surround it with a terrace 25 feet high and 200 feet in diameter, is estimated at $500,000. This sum there is an effort on foot to raise by public subscription, mainly through churches; but the patriotism of the people so far seems not to have resulted in very liberal donations. The Senate, however, has recently passed a bill declaring that Congress should assume the finishing of the work; and it will, therefore, if an appropriation be made, be paid for out of the national treasury instead of from the pockets of private citizens.

BARTLETT'S OZONE MACHINE.

The novel feature of this invention consists in the construction of the parts by which ozone is generated in separate tubes, and then purified as it passes from the machine into the atmosphere through the chemically prepared stuffs and wire walls. A is a hollow glass vessel having its inner sides formed into a series of half tubes, *a a*, and with sockets, *b*, in the center of each in the bottom. B is an inner cylinder, also of glass, having corresponding semicircular cavities, *c c*, formed on the outside, which, when the plunger is in position (inside the outer vessel, A), will form, in conjunction with the other parts, *a a*, a series of tubes around the interior of the vessel. This vessel, A, comprises the generating chamber. The plunger, B, is made hollow





with a closed bottom, and will be raised or lowered by a cord. The bottoms of the tubes, *a a*, receive phosphorus sticks, which stand up about two thirds of the length of each tube. The sticks are made flat and thin, being from one eighth to one quarter of an inch in thickness, and one inch in width, according to the size of the machine, and the upper part or combustion point is flattened or sharpened, thus giving the best oxidizing point. The object of raising and lowering the inner cylinder, B, is to regulate the hight of water around the phosphorus sticks, and thus graduate the combustion. By this simple arrangement any length of stick desired may be exposed for quick or slow combustion; and the machine may be left for days to run itself, the only attention required being to graduate the water by raising or lowering the plunger. Above the generating chamber is arranged an ozone chamber, C, the walls being formed of two thicknesses of wire cloth, the inner one being of much finer wire than the outer one. Between the two, and surrounding the entire chamber, C, is a porous fabric, which is first treated with an alkali, so that the fumes rising from the oxidizing phosphorus will be caught therein, and the acids and other impurities retained or neutralized by the chemicals having an affinity therefor. An expansion chamber, D, is set above the ozone chamber, C, to receive the surplus products of oxidation and allow them time to become separated from the ozone.

The apparatus is the invention of Mr. F. W. Bartlett, of Buffalo, N. Y., and was patented February 15, 1876.