quantities must be used, as it so quickly oxidises, and thus loses its protective qualities. The electrogen of Mr. Hannay's invention, which is rapidly gaining favor, is a very simple little appliance, and, as far as the writer has experimented with it, is very effective. The principle upon which it works is the setting up of a small galvanic battery in the boiler, by means of a ball of zinc cast upon a copper bar, and then hammered, to make it more impervious to the action of water; on each end of the copper bar a wire is soldered, and the two wires are again soldered to different parts of the boiler, so as to obtain metallic contact. Boilers which had shown a tendency to corrosion looked quite healthy in a very short time after these appliances had been fitted to them. Marine boilers are not troubled with much external corrosion, especially modern boilers, because much more care is now taken in fitting them into the ships than was formerly the case. They are now properly coated, and are not fitted too close down the bottom of the ship, plenty of room being allowed for access to the seams. But that all the mischief to be contended with is not confined to the waterside of the boiler is shown by the following incident. Some four and a half years ago the writer was called in to survey a boiler that had exploded and killed the chief engineer and fireman. Upon examination it was found that the bridges had been built up close to the backs of the combustion chambers; the dirt, etc. had been allowed to accumulate for some time, and corrosion had been going on upon both sides of the plate without being noticed. After the accident, when all had been cleared away, the iron was found to have oxidised so much that in some parts it was barely 1-16th of an inch thick; hence the explosion. The backs had been so built for the express purpose of economizing fuel; but experience goes to prove that this is a fallacy, and many cases could be mentioned where similar bridges have been taken out without making any difference in consumption of fuel, except that, if anything, the economy has been in favor of their absence. There is nothing like cleanliness to prolong the life of a boiler. When a vessel is to be laid up, a good plan is to pump the boiler full up to the very top of the dome, and keep it so until it is again required. Another method of preserving a boiler not in use is to empty it and clean it thoroughly, then close all the manhole doors except one at the bottom, put in a small stove full of burning coke, and close up the bottom door quickly. The object of both these methods is, of course, to exclude air as thoroughly as possible.—THE LONDON *"Iron."*

Engineering Notes.

COAL DUST FUEL IN FRANCE.—The United States Commercial Agent at Nantes says that the coal dust, which was formerly rejected as worthless, is now consumed in immense quantities in France in the form of "patent fuel," or coal bricks. The natural supply of dust from the yards of the coal merchants being entirely insufficient for the needs of the brick works, the manufacturers, particularly in the Nantes district, import a large quanity of coal dust from Cardiff, Swansea, and Newport. The process of manufacture is very simple. The coal dust is mixed with pitch, and the mixture poured into cups attached to a belt, each cup containing just enough material for a brick of the size desired. The belt in its movement passes this material through a chamber where it is exposed to steam, which fuses the two substances into a homogeneous mass.

This is poured by the descent of the belt into moulds, where it is subjected to an enormous pressure by a hydraulic press or by machinery set in motion by a steam engine. The brick is square in form, its thickness being about one-third of its other dimensions, and it weighs five, ten, or fifteen pounds. Certain of the French railway companies refuse to accept fuel unless at least 10 per cent. of pitch has been used for its agglomeration. It is stated that briquettes are preferable to ordinary coal for exportation to the colonies and to warm climates on account of their compact storage and freedom from small fragments and dust, also for use on locomotives, both on account of economy of space and because firemen can always determine the amount of fuel they are employing in a given time, the weight of each brick being exactly known. The manufacturers claim that the "patent fuel" is more healthy for domestic use than ordinary coal, citing in support of this theory the declaration of certain well known physicians. At the present day a large number of bricks are made for domestic use, of small size, and perforated with circular or longitudinal openings.

TREES AND PLANTS AS PURIFIERS.—The beneficial effects which plants and trees may produce on dwelling-sites and on the air of habitations have been made the subject of a paper by Dr. James Evans, before the South Carolina Medical Association. The network of fine fibrous roots of trees and plants, traversing the soil in every direction, feed on the organic matter which would otherwise undergo decomposition, polluting the soil, air, and surface water. The vegetation also absorbs excess of moisture and drains the soil. This moisture is afterwards exhaled from the leaves, and there is no doubt that plants also exhale, with the moisture, some of their active and peculiar principles. The scent of mint and thyme is due to menthol and thymol, antiseptics of the highest value, and it is not improbable that their exhalations have the same property. The eucalyptus is remarkable as a prophylactic against malaria. Its leaves immersed in hot water are also said to be an efficient disinfectant in the sick room. By virtue of their power to generate ozone and to split up carbonic acid, absorbing the carbon and setting free the oxygen, plants remedy to some extent the evils of bad ventilation. In Pasteur's virus-culture experiments he found that, when they were conducted under a diminished supply of oxygen, the germs retained their primitive virulence, but, on the contrary, when they had access to oxygen the virus became weaker. It has been known for a long time, that marsh miasm is intercepted by a forest, and that persons living in a locality so screened are exempt from attacks of malarial fever. The explanation of this is probably to be found in this discovery of Pasteur. When a cloud of malarial germs are wafted from a marsh to the neighboring forest, they encounter a continuous stream of oxygen pouring forth from every leaf, attenuating the virus and rendering it innocuous.—*Sanitary Engineer.*

SETTING WATER WHEELS.—In preparing to set wheels first excavate wheel-pits (if there be none, or not of sufficient depth), put down mud-sills and shut them over with two inch plank (unless there be a rock bottom). These pits must be from two to five feet in depth, according to size of water wheel. It should always be borne in mind that too free a discharge can not be made. Wheels should always be set so that the draft tube or cylinder will set at least two inches in tail water when standing. The tail-race as well as the wheel-pit, should be both wide and deep, and, if possible, the level of bottom of wheel pit should be carried on the whole length of the tail race to the stream, which is easily done when the race is short. When the desired depth can not be given the whole length of the tail race, in should be made up in width, and in this case the bottom of tail race should slope gently to bottom of the wheel pit, in order to avoid an abrupt opposing surface. There should be, if possible, two feet in depth of dead water in the tail race when the wheel is not running, in order to avoid the raising of the water in the tail race and consequent loss of head. In placing the wheel, great care must be taken to see that the wheel sets perfectly level. No fastening is required to keep the wheel in position, as its own weight and the pressure of the water will hold it in water.

MARVELLOUS ENGINEERING —The London Inner Circle Railroad is a marvelous feat of engineering skill. It runs throughout its entire distance under the busiest centre of the largest city in the world, and the operations attending the excavation and construction have proceeded without injury to or interruption of business or traffic. Quicksands have had to be passed through, beds of old rivers spanned, lofty warehouses and massive buildings secured while their foundations have been undermined, and an intricate network of gas and water pipes sustained until supports had been applied to them from below. Added to this the six main sewers had several times to be reconstructed. Day and night the work has been carried on for 18 months, and now the engineers are able to announce that their tunnel is complete. The laying of the rails and the building of the stations are the only portions of the immense work that remain to be done, and in a very short time trains will be passing over the whole of this wonderful subterranean road.

POLISH FOR PINE WOOD.—A wash of one part nitric acid in ten parts of water will impart a stain resembling mahogany to pine wood that does not contain much resin. When the wood is thoroughly dry shellac varnish will impart a fine polish to the surface. A glaze of carmine or lake will produce a rosewood finish. A turpentine extract of alkanet root produces a beautiful stain which admits of French polishing. Asphaltum thinned with turpentine makes an excellent mahogany colour on new wood.