**Machinery and Tools as they are.---The Steam Engine.**

(Continued from page 107.)

Steam Boilers—To a person unaccustomed to consider the subject, it may appear, at first sight, a matter of small moment as to the form in which a steam boiler should be made, but when it is remembered that a large manufacturing firm will expend several thousand dollars for fuel in the course of a year, or that a large steamship may require a thousand tons of coal in the duration of a voyage, it is evident that a strict attention to economy in this matter is very requisite. The question, therefore, is—how can fuel be best saved? a problem to be solved by attention to two circumstances, namely, the generation of steam in the boiler and its subsequent use in the engine. The former branch of economy is dependent upon two facts,—the evolution of heat by the combustion of the fuel in the furnace, and the subsequent absorption of this heat by the water. Notwithstanding the progress of steam machinery and the vast practice which many engineers have possessed, it is certain that there is no precise theory for the steam-boiler, from which all the necessary data can be derived for the construction of a boiler of any given evaporating power. The greater part of the rules followed by boiler makers are founded on the practice of their predecessors, and as they generally make a boiler larger than necessary, the chief requisite, a sufficient supply of steam is easily obtained, although often at an unnecessary expenditure of fuel. In discussing this subject we shall begin with marine boilers: these have, of late years, undergone considerable change as to form, which, in this country has been induced by the desire to use anthracite coal instead of wood for the consumption of river and lake steamers. A similar revolution has been effected in the boilers of European vessels, caused by the desire to use steam of a higher pressure, and to diminish the space occupied by this indispensable adjunct to the engine, and also to lessen the weight. All these improvements have tended to discard the use of rectangular flues, and to introduce the employment of tubes, sometimes of small diameter, while in other instances a few tubes of larger diameter, and made of boiler-plate, are used instead. The boilers of our river vessels are generally cylindrical, except the part for the furnaces, two rows of large boiler-plate tubes convey the heat through the water to the further end of the boiler, thence it returns through one or two rows of larger tubes to the front of the boiler, and so up the chimney. In other cases two boilers are placed together, fore-and-aft, and one chimney being made to serve for them both, the heat is re-conducted from the front by an additional row of tubes. With respect to the number of the latter, we will remark that the main or lower ones are generally five in number for each furnace, being arranged to suit the cylindrical shape of the boiler, the upper or return tubes are generally placed five in a row.

There is another variety of the tubular boiler, more especially adapted for sea-vessels because, although by no means so strong as the one we have just alluded to, it is better adapted for placing below deck, as it approaches to a rectangular shape, the top part, however, being generally more or less arched, in order to gain additional strength. In boilers of this description it is usual to employ a considerable number of small tubes, which are from two to three inches in diameter. These tubes are sometimes horizontal and frequently vertical—many of our largest steamers employing boilers of the latter kind, some of which have given extremely satisfactory results as respects the weight of water evaporated by one pound of coal. This, in boilers of the ordinary construction varies from 8 to 10 lbs., but in some of these latter it amounts to 12·9 lbs, which may be attributed to slow combustion combined with the mode of arranging the flues and tubes. In those boilers which have horizontal tubes, and most are of this sort, the heated air can either pass directly through them to the chimney, or if one large passage be used for the main flue, the tubes are so disposed as to return the hot air to the front of the boiler, whence it passes to the chimney. The following particulars of a boiler with horizontal tubes, and intended for a low-pressure engine, will give an idea of the present state of this branch of the Steam Engine. The cylinders being 61½ inches diameter, and 4 feet 6 inches length of stroke, the weight of the boilers exclusive of water, was 45 tons, the tubes, which consisted of iron were 3 inches diameter and 6 feet long; the grate-bar surface was 85 square inches per horse-power, the total tube and flue surface 16 square feet per horse-power.

Of the rectangular flue boiler, formerly placed in steamers, we will say nothing, as the use of it is almost entirely abandoned.

The wagon boiler for stationary engines has, in a similar manner, sunk in estimation, being supplanted by those of a cylindrical shape, but whatever the form may be, attention to certain principles is requisite to insure a satisfactory result. Locomotive engineers have almost totally expunged the term horse-power from their nomenclature, but as it is still retained in other branches of steam machinery, it is necessary for the boiler-maker to know its import as respects his business; this is generally defined to be one cubic foot of water evaporated per hour, although, in fact, the power developed by this quantity is much greater in all modern engines. The necessity of "hard firing" will be avoided by the experienced maker, who, aware of the consequent injury resulting from this practice will take care to allow sufficient fire surface. A cylindrical boiler, with an internal flue, is very frequently used, and in the Cornish variety the fire-grate is formed in the entrance of the latter. Plain cylindrical boilers, without any inside flue and enclosed by brick-work, in which the furnace and flues are built, are extensively manufactured. In all these sorts of boilers an excessive length is useless, but the quality of the fuel materially influences the ratio which should exist between the diameter and the length. A cylindrical boiler with double internal flues and furnaces has met with considerable success.

To enumerate all the different varieties of boilers is not our intention,—before closing, however, we will mention that species which has, perhaps, exercised more ingenuity than any other—namely, that in which the water is enclosed in tubes and surrounded by the flame and hot air; doubtless no boiler is better adapted for generating high-pressure steam with rapidity, but its glaring deficiency, as regards safety and economy, are well known. Respecting the locomotive boiler there is little to be said, as it has remained nearly similar in form for many years. The only modification of note is in its being often made of an elliptical shape instead of cylindrical, thus affording a more powerful boiler without detracting from its safety.

[For the Scientific American.]

**Speaking through Tubes.**

Noticing in this week's number of the Scientific American an article on Acoustic Telegraphs, I take the liberty of pointing out to you some experiments made by Biot, in one of the pipes of the water works in Paris, the distance being 951 metres (over 3,000 feet). The principal results of these experiments were:—

1st, The time taken in asking a question, and receiving an answer, was 5″58, during which the sound of the voice had been propagated twice through the length of the pipe or over 6,000 feet.

2nd. The softest whisper which could possibly be articulated, was distinctly understood.

3rd. Low and acute sounds, as well as loud and soft ones, were propagated with equal velocity.

The bore of the pipe is not given, but from the length of the pipe, I suspect that it was probably one of the mains from the distributing reservoir, which, if I recollect right, are not less than twelve inches, perhaps more.

The experiments were made, not only with the voice, but by firing pistols, playing the flute, &c. But it was found necessary to make the experiments during the greatest stillness of the night, because in the day time, in such a large city, the atmosphere is filled with such confusion of various sounds, and the ground so much jarred by carriage wheels and other causes of constant friction and percussions that metallic pipes of such size, are affected by vibration, and the column of air within was at times so filled with confused noises, as to render inaudible even a loud call. This, however, would not be the case in small gutta percha pipes. C. S. Quilliard.

Rondout, Dec. 11th, 1852.

**Deterioration of Soils---Agricultural Report of Ohio.**

We are indebted to the Rev. C. Springer, of Meadow Farm, Ohio, for the Agricultural Report of Ohio for 1851, in which we find much that is valuable to the Agriculturist. We select the following from it, which touches the question of the "rotation of forest trees," published on page 302 of our last volume.

In a state of nature, soils do not deteriorate, but are maintained in a state of uniform or increasing richness.

The trees and plants of spontaneous growth, are of various kinds. Each takes certain elements from the soil, and from the air, the rain, and dew; but the decay of the various parts of the trees and plants, and the reliquiæ of the various animated beings that subsist on animal life, restore to the soil those elements that had been taken from it, except the small quantity removed by the washing action of water—and even this is compensated on the hills by the washing away of the surface soil, and exposing fresh mineral matter to decomposition—and on the low grounds by their receiving the exhausted materials washed from the higher.

Trees draw their mineral elements from a greater depth than the roots of smaller plants, and by their decaying leaves, furnish both organic and inorganic food to themselves, as well as to the smaller plants beneath them.

The excrementitious parts of one plant serve as food to others, so that certain associations of plants and trees are always found, in a state of nature, to characterise certain kinds of soil.

There is a natural rotation of timber growth, so that as soils become more or less loaded with excrementitious matter, so as to be no longer capable of producing a vigorous growth of the same trees and plants, another growth of different plants and trees succeeds.

This order of succession has been partially traced by Rev. C. Springer, but many and long continued observations will be necessary to trace out the natural rotations of the different kinds of timber, on the different kinds of soils. The kinds of rotation best for some of the annual plants raised for the food of man and animals, on some kinds of soils have been ascertained, but little is known of the general laws that may and ought to be ascertained.

Under culture, soils deteriorate unless they are regularly manured. The removal of any crop, natural or artificial, removes elements that must be restored, in order that its fertility should not be impaired. Mineral acids, alkaline earths, silica in a soluble state, chlorine, iron, &c., are removed, equal in weight to the ash that would be obtained by burning the plants removed. Most of these elements exist in a very minute proportion in the soil in a state to enable the roots to absorb, and plants to assimilate them, so that continued cropping, without returning any thing, will soon exhaust one or more of these elements, and the land becomes poor, and must be manured with something to supply the lacking elements—or it must be left at rest in fallow, as it is called, to give time for more of the mineral elements to be liberated, by the gradual decomposition of the particles of minerals in the soil.

Crops removed from the ground carry away not only a large amount of vegetable matter, but also those mineral materials taken up by plants, small in amount, it is true, but indispensable to the perfection of the plants raised.

The straw, stalks, and leaves of the plants, if returned, restore in part the waste; but still, the phosphates which enter in large proportion in the mineral elements of the seeds, are found in small proportions in the other parts of the plants, and the soil becomes gradually impoverished of the elements which are small in amount in all soils, but which are indispensable to the growth and perfection of the seeds of plants. Soils may be and frequently are capable of producing a rank growth of straw, which produce a small yield of grain. Plants will not produce more seeds than they can perfect.

Of the exact composition of the soils of Ohio, little is known, as few analyses have been made. Of the exact composition of the various grains, plants, and their different parts, as well as vegetables, comparatively little is known; but the relations of the plants and the soil on which they grow, and what and how much is taken from the soil by these plants in each stage of their growth, and how much is removed by our mode of culture, are important facts to be known to the farmer.

It is not mere cropping alone with grain, that causes a deterioration in our soils. The flesh, wool, hair, horns, bones, butter, cheese, produced by grazing and marketing our farm products, carry away large quantities of elements from the soil that impoverish it, and diminish its productiveness. The results of this system are now beginning to be felt as much in the dairying, grazing, and sheep farms of Ohio, as where grain has long been raised. The mineral elements removed in the numerous agricultural products are more or less concentrated in cities and villages, where they are permitted to be lost, or they are sent to far distant markets, where they are lost for ever.

**The Sphinx.**

What the Egyptians signified by the symbolical figure, seems not to be exactly decided. I think it was the type of womanhood, in which power is engrafted on beauty and gentleness. This they represented by a woman's face, neck, and bosom, terminating in the body of a lioness, not in fierce or violent action, but in eternal repose. This is the nature of the passive principle, which receives within itself the germs of life, and quickens and brings them to perfection without any external manifestation of energy. Possibly, also, the Egyptians meant to insinuate that though the female sex is placed as our companion upon earth, it is never understood by us, but will remain, like the sphinx, an enigma to the day of doom. However this may be, I take it for granted that the approximation of sphinx and pyramids was not altogether accidental. The stranger and traveller who approach might learn from the mystic figure beneath the rocks, that around him was all symbol and allegory, and that if he could not read the riddle of its existence, he could scarcely expect to interpret the most abstruse of all symbols on the sacred mount. In all ages there has been an esoteric philosophy, a doctrine and language confined to the few, and even now, they who as travellers journey over the surface of the earth, must veil a portion of their discoveries behind an obscure terminology. When perfect, the sphinx, in all likelihood, formed the crown of Egyptian art. There is something inexpressibly majestic in the dusky head, suggesting the idea of a buried goddess, emerging from beneath the sands; and if we contemplate the outline of the features, and restore what centuries have mutilated and marred, we shall probably have a perfect type of the beautiful as it existed in the mind of the Egyptians.—[J. A. St. John.

**Cast-Iron Pavements &c.**

The citizens of Boston are real utilitarians, and possess more municipal enterprise than those of any other city in our union. They have an electric fire telegraph for the whole city, which has been in operation for at least a year, and now they are laying down cast-iron pavements.

We understand that the people of Boston have adopted the plan of sweeping and cleaning the streets during the night, and that the plan works admirably. We recommended the adoption of this plan to our citizens two or three years ago, also repairing the streets during the night, but our wise gothamites will not be easily made to adopt such reasonable city reforms. We are glad to know that one city has.

The Circleville Watchman (Ohio,) says that John Brotherlin, Esq., of that place, has constructed a tea kettle made of copper, all complete and entire, and which weighs less than one twelfth part of a cent. This is a triumph of nice-handed workmanship.