THE THAMES EMBANKMENT.

This celebrated structure, of which we this week present an excellent engraving, has many points of interest both to the engineer and the general reader. One result of its construction was the reclamation of the land lying between the present beautiful water front and the rear of the houses in Whitehall Place and Whitehall Gardens, London, including all that shown in the engraving between the buildings and the water front formed by the embankment, and which now forms a beautiful park.

The ground between the wall of masonry, that forms the frontage on the river and the buildings, is all made ground. Along the front, parallel to the wall, runs the Metropolitan Railway (underground), one depot being in the extreme background, facing the clock tower of the Houses of Parliament.

The statue in the center of the Park is that of General Sir James Outram, a distinguished soldier and statesman. The Nelson Monument in Trafalgar Square is seen at the extreme right of the picture.

A difficulty as to the title of the ground thus reclaimed arose between the general government and the Metropolitan Board of Works, the former claiming that the title should be vested in the Crown, and the latter that it should belong to the Board. The difficulty was adjusted by a compromise, in which the Board of Works leases the land from the Crown for the purposes of a public garden; so that the Crown derives a rental, and the public get the benefit of the park, as originally intended.

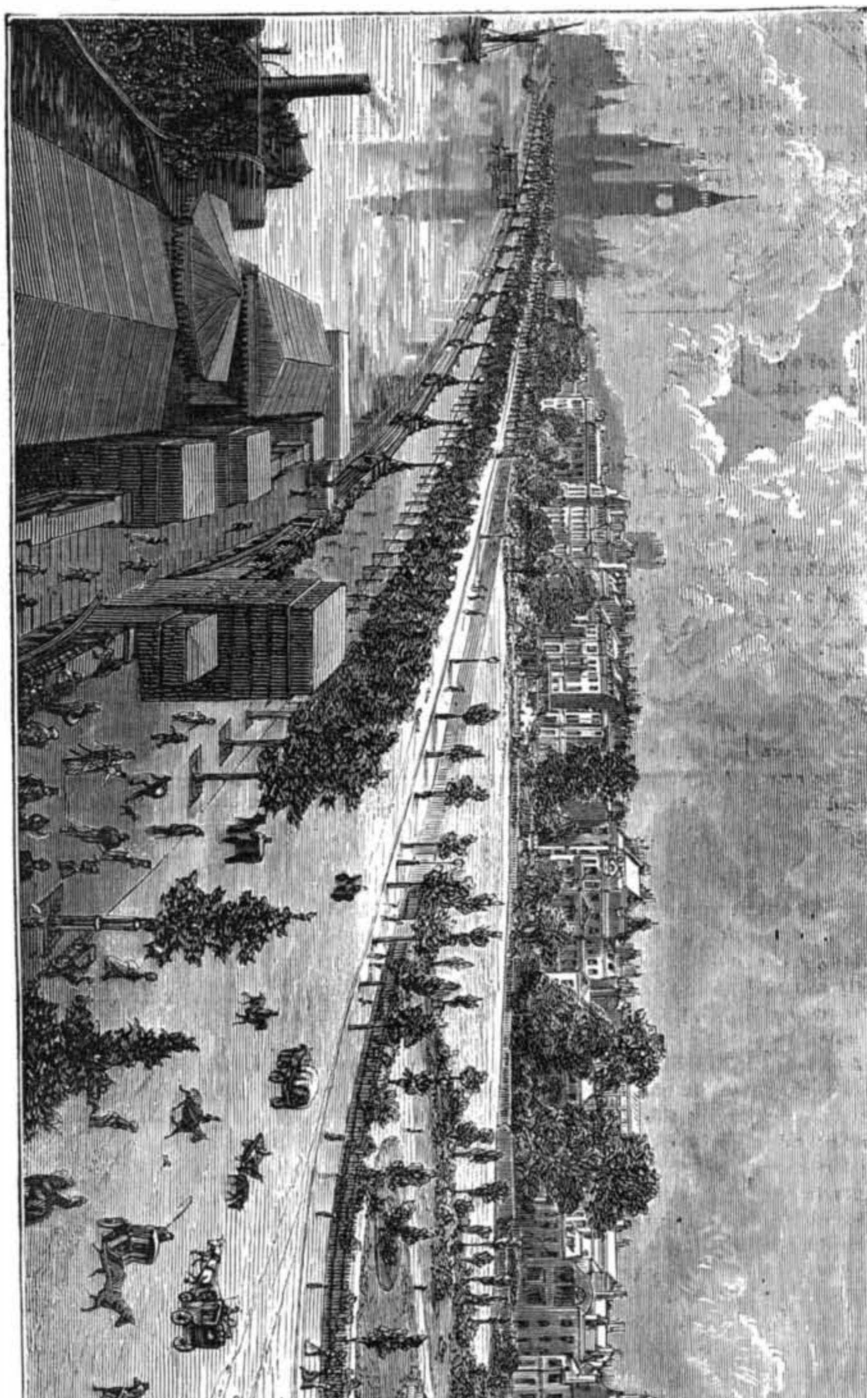
The work exacted some nice engineering skill for its performance. We cannot give our readers a better idea of its general character than by the abstract of a paper read, before the Institution of Civil Engineers at their first meeting of 1870, by Mr. Thomas Dawson Ridley, which follows. The paper read was a "Description of the Cofferdams used in the execution of No. 2 Contract of the Thames Embankment."

This contract extended from the landing pier at Waterloo Bridge to the eastern end of the Temple Gardens, a length of 1,970 feet. Mr. J. W. Bazalgette (M. Inst. C.E.), was the engineer-in-chief, and Mr. Edmund Cooper (M. Inst. C.E.), was the engineer; the author of this paper having charge of the works for the contractor.

The breadth reclaimed from the river by this portion of the embankment varied from 110 feet to 270 feet; the depth of water, when the tide was low in front of the wall, averaged 2 feet; and the rise of tide was 18 feet 6 inches. The borings showed the bed of the river to consist of sand and gravel, resting upon the London clay, at depths varying from 21·58 feet to 27·10 feet under low water mark, while the foundation of the wall was, in all cases, designed to be carried down to a depth of 14 feet under low water mark.

It devolved upon the contractor to design dams to the satisfaction of the engineer, who reserved to himself the power to adopt either caissons or cofferdams. The author considered that dams of timber and puddle would not only be cheaper, but could also be more expeditiously constructed, than iron caissons; and having succeeded in obtaining the engineer's sanction to one of the plans which he submitted, the work was begun.

The Temple Pier was the most important work in the contract, and it was therefore requisite to lay its foundation dry as soon as possible. To effect this, two short dams, one at each end of the pier, completely inclosing a short length of the river wall, were first begun. No. 1 was 111 feet 6 inches long by 25 feet broad, inside measure, and No. 2 was of similar breadth, but a few feet longer. These dams consisted of two rows of piles of whole timbers, averaging 13 inches square, with a clear space of 6 feet for puddle. The piles were from 40 feet to 46 feet in length, having cast iron shoes 70 lbs. in weight, and were driven 40 feet into the clay. Cast iron was used in preference to wrought iron for the shoes, as giving, at an equal cost, a much larger base for the timber to rest upon. Where the driving was difficult, shoes having cast iron bases and wrought iron straps were employed. The piles were secured by three rows of walings of whole timbers, 13 inches to 14 inches square, through which and passing through the puddle space, at distances of 6 feet 6 inches horizontally, were bolts, $2\frac{1}{2}$ inches in diameter in the lower waling and 2 inches in diameter in the middle and upper walings. Cast iron washers, 9 inches in diameter and $2\frac{3}{4}$ inches thick, were used to distribute the pressure over a large surface of the walings. To avoid the difficulty of having to procure a number of long timbers, the piles were in a few cases only of the full length required, and the others, after being driven, had lengthened pieces fixed to them, so as to raise the dam to a hight of 4 feet above the high water line. Before proceeding with the construction of these two dams, the ground was not dredged, but in all the dams subsequently constructed, the sand and gravel were cleared off to the level of the clay before the piles were driven. Where the ground had not been dredged, great difficulty was experienced in driving the piles, and in the two dams in question one sixth of the whole number pitched, having shown symptoms of failure, were drawn. In all cases the piles so drawn were observed to have cast their shoes, and their lower extremities were usually bruised into a mass of tangled shreds. The failure generally occurred when the piles were passing through a bed of compact sand, resting upon coarse open gravel. Beneath the gravel, and resting upon the clay, was a layer of septaria, which offered a serious impediment to the passage of the piles; but when once the clay was reached, the driving was comparatively easy. The space between the piles was dredged to the level of the clay and filled with well tempered puddle. The transverse struts, of which there was a tier to each waling, were of whole timbers, 8 feet apart in the length of the dam.



THE THAMES RIVER EMBANKMENT, LONDON, ENGLAND.

Simultaneously with the construction of these dams, the filling in of the space behind the Temple Pier was going on, the line of the dam was being dredged, and the driving of the piles begun. The Temple Pier, 470 feet in length, was irregular in outline, projecting in some parts upwards of 30 feet in advance of the river wall, and the breadth across the foundation trench in the center part was 57 feet. To avoid the necessity of having to use a large number of struts of such great length, this dam was strengthened by means of buttresses of piles, somewhat similar to those used in the cofferdams constructed for the Grimsby Docks. These buttresses were placed at intervals of 20 feet, and were backed up by struts extending across the foundation of the pier. The scantlings of the timber and the sizes of the bolts in this dam were similar to those in dams Nos. 1 and 2, the walings only being a little stouter, averaging 14 inches square.

Before No. 3 dam was completed, No. 4 dam was begun, and was followed by dams Nos. 5 and 6. In these and in all the dams, except No. 3, the inner row of piles was placed so as to coincide with the riverward face of the concrete in the foundation trench. The piles, walings, and bolts of these dams were similar to those in dams Nos. 1, 2, and 3; but the shoring was of a different character. Across the breadth of the wall the struts were all horizontal, and abutted against walings of whole timbers, bolted to pairs of piles, driven into the solid ground behind the foundation of the wall. These coupled piles were placed at distances of 18 feet apart from center to center, and were further supported by three back struts to each pair, two of which were horizontal and one raking. These struts abutted against piles driven into the slope of the filling material, and backed up with rubble stones. From the lower waling to the bottom of the trench, or to the solid ground, the space in all the dams was filled up with clay, or with a mixture of clay and gravel, to give further stability to the dam, and to assist the lower bolts to resist the pressure of the puddle. Sluices of $4\frac{1}{2}$ inches elm plank, and having hinged flaps, were inserted in each dam through the piles and puddle at the level of the lower waling. For dams Nos 1 and 2 these sluices were 8x8 inches, internal cross section. In the Temple Pier dam, there were two sluices, 3 feet high and 1 foot wide, and for each of the other dams there was one sluice of similar section. In the Temple Pier dam, two iron cylinders, 8 feet in diameter, were sunk to a depth of 4 feet below the lowest level of the foundation for pump wells, and in each of the other dams one such cylinder was sunk. The volume of water, filled out of the Temple Pier dam, varied from 620 gallons to 1200 gallons a minute, according as a less or a greater area of the foundation was exposed; but in all the other dams there was much less water to be pumped. As soon as the walls in any of the dams had been raised 6 feet above low water mark, no further pumping was needed, as the water which gathered when the tide was high was passed through sluices at low water. Murray's chain pumps were used in all cases, and were found to be very efficacious.

In the cofferdams there was usually a frequent settlement of the puddle, producing channels underneath the bolts, and a consequent leakage. In such cases holes were bored, with a 3 inch auger, through the inner row of piles, immediately below the tie bolts, and pellets of clay were driven through these into the puddle until the leakage was subdued.

When the dams had served their purpose, it became necessary to clear them away, and before the completion of the whole series. the removal of those first constructed had been begun. The piles in front of the ordinary wall were cut off at a level of 3 feet under low water mark, and those in front of the Temple Pier at a level of 7 feet under low water mark. The removal of the piles and puddle was effected in the following manner:

Upon the tops of the piles of each side of the dam half beams were fixed, and upon these rails were laid so as to form a road, upon which the steam cranes and dredging machines, to be used in the removal of the puddle, could travel, and upon which the pile cutter could also be moved. These machines were successively placed in position, and the work was begun. For the first 15 feet in depth, the puddle was filled into skips and hoisted by means of steam cranes. Below that depth, it was dredged by the machines which had been used for excavating the trench. When the puddle had been cleared away to the requisite depth, the pile cutter followed and performed its part of the work. This machine consisted of a platform upon a stout frame, resting upon four wheels which traveled upon the rails before mentioned, and carrying a steam engine with the requisite machinery for driving a circular saw, which was fixed at the lower end of an upright spindle, and adjusted to the proper level. The spindle was placed between the two rows of piles, and revolved in guides at the end of movable arms, so arranged that it would shift to either side of the dam by turning a handle, and by the same motion it could be pressed towards the pile, which was being operated upon, until it was severed by the saw. Two piles were usually cut off on each side before the machine required to be moved backward on the rails. When the way was clear for the pile cutter, and a sufficient length of dam dredged, sixty piles could be cut off in a day; but the excavators could not keep pace with the pile cutter, and the average number of piles actually cut off did not exceed thirty.

A Chance for an Inventor.

The *American Builder* for December, published by Charles D. Lakey, 190 South Sangamon Street, Chicago, appears on our table as fresh and beautiful as though there had been no fire and no wholesale destruction of the appliances by the aid of which it was formerly issued. This monthly has always been one of the most welcome of our exchanges, and we congratulate its editors upon the vitality of an enterprise that could sustain such a shock and still survive. As a specimen of the many good things in it, we extract the following, under the title given above:

"Our inventors seem always happy in getting up new devices for churns, washing machines, and the like; but they seldom trouble their heads about any improvements in the art of building. Architects never invent. They invariably follow in the path of precedent, and are happy just in the ratio that they succeed in doing things as they have been done by others.

"If inventors would examine into our present system of building, with a view to making needful improvements, they would put money in their purses. Just now, we need some method for protecting warehouse windows; a system, too, which shall guarantee the closing of iron shutters, and not the leaving of them open one night in the year, and that night the one when the fire comes. Then, too, we want the street fronts protected by these iron shutters; and they are so unsightly that it can be done by no ordinary method. Here, then, is a plan; and the first man who gets ready the papers can secure the patent:

"Let plain iron shutters (cast iron of sufficient thickness will answer) be constructed and placed in the brick work, which is to be so laid that the shutters shall slide laterally. Arrange for the construction of a series of shafting while the building is going up, which shall be worked from the engine that is used for hoisting. When the store is closed for the night, the engineer, by the simple action of a lever, draws a solid sheet of iron over every outside window and doorway, save the one by which he leaves the building. Such a building, with a roof of stone, concrete or iron—providing the architect has not loaded the cornices with wood—might be considered nearly proof against fire from the outside.'

A Fireproof Man.

About the year 1869, one Lionetto, a Spaniard, (writes a French chemist,) astonished not only the ignorant, but chemists and other men of science, in France, Germany, Italy, and England, by the impunity with which he handled red hot iron and molten lead, drank boiling oil, and performed other feats equally miraculous. While he was at Naples, he attracted the notice of Professor Sementeni, who narrowly watched all his operations, and endeavored to discover his secret He observed, in the first place, that, when Lionetto applied a piece of red hot iron to his hair, dense fumes immediately rose from it, and the same occurred when he touched his foot with the iron. He also saw him place a rod of iron, nearly red hot, between his teeth, without burning himself, drink the third of a teaspoonful of boiling oil, and, taking up molten lead with his fingers, place it on his tongue without apparent inconvenience. Sementeni's efforts, after performing several experiments upon himself, were finally crowned with success. He found that by friction with sulphuric acid diluted with water, the skin might be made insensible to the action of the heat of red hot iron; a solution of alum, evaporated until it became spongy, appeared to be more effectual in these frictions. After having rubbed the parts which were thus rendered, in some degree, insensible, with hard soap, he discovered, on the application of hot iron, that their insensibility was increased. He then determined on again rubbing the parts with soap, and after this found that the hot iron not only occasioned no pain, but that it actually did not burn the hair. Being thus far satisfied, the Professor applied hard soap to his tongue until it became insensible to the heat of the iron; and having placed an ointment, composed of soap mixed with a solution of alum, upon it, boiling oil did not burn it; while the oil remained on the tongue, a slight hissing was heard, similar to that of hot iron when thrust into water; the oil soon cooled, and might then be swallowed without danger. Several scientific men have since, it is said, successfully repeated the experiments of Professor Sementeni, but we would not recommend any but professionals to try the experiments.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

To Smoke or not to Smoke.

To the Editor of the Scientific American:

The problem: if one drop of nicotin kills a rabbit in three minutes and a half, how many cigars must a man smoke to reach a state of locomotorataxy, reminds me of another arithmetical query no less profound, to wit: If eight shillings make one dollar, how much milk does it require to make a pair of stockings for an elephant?

The mere fact that nicotin is a poison for one species of animals is no proof of its similar effect on all others. I could quote an endless line of examples in favor of this assertion. Thus, *phellandrium aquaticum* is fatal to horses, but may be eaten with impunity by oxen; *doronicum* kills dogs, but fattens antelopes, thrushes, and swallows; the *cocculus indicus* is deleterious to fish and lice, but a salutary ingredient in the best London porter.

But, even granted that tobacco contains matter poisonous to the human system, let me ask what does not? Potatoes, cereals, and, in fact, nearly all vegetables, contain alcohol or other matter, which, if taken alone or in overdose, may kill a man in two minutes and a quarter. Even the very air we breathe is replete with nitrogen and other deadly gases which the anti-smoker would do well to avoid. The mere proof, therefore, that the extract of tobacco is a poison should not suffice as a conclusive argument against its use. It is stated that tobacco reduces the vital energy of the system. It may as well be said that nothing draws so much on the vital powers as the hewing of trees or plowing of fields. Such labor virtually tends to exhaust the system; but does not nature, when properly sustained by food and rest, amply repay the outlay? Does not just this exhaustive practice tend to build up a stock of iron nerve and muscle? The same with mental labor. Nothing so draws on the brain as the continuous and active production of ideas; still nothing will make a more powerful mind than just such exhaustive production, if sustained by food and rest. Therefore tobacco can safely be considered a benefactor in the same line as muscular or mental activity. It partially reduces the system only to give nature an opportunity to replenish with opulence. This argument is of course only applicable to healthy persons. Invalids should apply to their medical advisers, even such invalids whose disease consists in lack of courage to withdraw their minds from the molds wherein they were originally cast.

Now let us observe the practical application of the weed: Germans are said to be the greatest smokers; cigars are drawn among the regular rations by their soldiers. And where do you find more powerful men, both mentally and bodily, than in the land of Humboldt and Bismarck? While, on the other hand, the fact that the Chinese and Shakers do not smoke does not speak much in favor of total abstinence.

Nevertheless I would advocate the discharge of that inverted distilling apparatus, the pipe, which, unless kept scrupulously clean, that is, used just for one smoke, appears the filthiest thing on record, the chewer's palate always excepted.

Your statement, Mr. Editor, that you are always willing to give room to both views of a question, makes me bold in submitting mine to your consideration. I would earnestly warn against a too narrow view of any subject. This is no longer the day for the supremacy of any one abstract science. All the exploits of thought should be used in determining our difficult problems. We only heard the doctors thus far. Let us know what the laymen have to say. At any rate, I must personally protest against your concluding sentence, for should I ever see fit to smoke, I will do so deliberately, neither thinking myself a hypocrite, a corrupt man, nor a fool. V. B.

Influence of the Moon on Timber.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of September 3, 1870, on page 148, I wrote an article on "Moon Fallacies," and asserted that if hickory timber be cut, say three or four days after a full moon, that the worms would devour it; and that if the same kind of wood be cut, say three or four days after a new moon, the worms would not touch it; and I invited some of your country correspondents to give the matter a trial, and report the result. D. E. S., of Oneida, N. Y., claims to have tried it, and in the SCIENTIFIC AMERICAN of April 15, 1871, on page 244, his report is that "the piece of hickory cut in the full of the moon shows no indication of being worm eaten." He says: "at the end of another six months, I will again report."

On page 228 of the SCIENTIFIC AMERICAN, October 7, 1871, D. E. S., writing from Wallingford, Conn., makes another report on the sticks cut by him. He says: "It is now over a year since I cut two hickory sticks, three days after a full moon, marked them, and placed one in the ground out of doors, and the other in an old garret. Three days after the next new moon, I cut two more sticks, similar to the first, marked them, and placed them beside the first. I send you a section of each, properly marked, by which you will see there is no perceptible difference between those cut in the old, and those cut in the new, of the moon." You add: "the specimens show no difference, and we regard the experiment as conclusive."

After reading the article written by D. E. S. last April, I concluded to give the matter a trial myself; accordingly, on the 9th of May, 1871, four days after a full moon, I cut two sticks of white hickory, marked them, and laid them up in a dry loft; and on the 24th of May, 1871, four days after the next new moon, I cut two sticks of white hickory, similar to the first, marked them, and placed them with the two cut on the 9th. It is now six months since the sticks alluded to were cut, and I send you a section of each. You will find that those cut in the old of the moon, or four days after the full, are so badly worm eaten as to render them almost useless for anything but fuel; whilst those cut in the new of the moon, or four days after a new moon, are sound, hard and dry.

As I stated in my first article; I do not know, or pretend to argue, that the moon exerts this influence, yet it is quite evident that there is a right and a wrong time to cut timber; and so far as I know, we can only be governed by the phases of the moon as to the proper time.

In cutting hickory in the old and new of the moon, the differences, of which I speak, will be perceptible in a shorter time where the wood is cut while full of sap, or while the leaves are on the trees. I feel satisfied that the sticks cut by D. E. S. will show a perceptible difference in the course of time.

This question, of a proper time to cut timber, is a matter of great importance to all who work in timber, either in manufacturing, or using it for posts or building material.

In volume XXV, No. 22, November 25, page 346, in query No. 6, S. F. says he is engaged in a business where he uses hickory, and wants a "simple preventive for worms in hickory." If he will observe the rule I have given about cutting his timber, he will have no trouble, namely: commence cutting white hickory about three days after a new moon, and cut to within about four days before the next full moon. I have never tried this test on "red hickory," (which may be the kind D. E. S. experimented on).

The whole subject is worthy the attention of scientific men; perhaps by further experiments and observation, the true solution may be arrived at; and if the moon *does not* exert this influence on the durability of timber, the true cause may be ascertained.

Cincinnati, O., November 28, 1871. D. A. M.

[The samples sent are as described by our correspondent. The two sticks cut four days after the full of the moon are very badly worm eaten, while the others show no signs of attack. The experiment of our former correspondent, D. E. S., showed no difference in this respect between timber cut shortly after the new and the full of the moon. That this proves the moon has nothing to do with the worms, seems still conclusive to us. If further experiments are to be performed, we advise that many specimens be subjected to trial, instead of making the comparison between two or four. The average result of such an experiment would be a far more reliable indication than can be obtained from so small a number of specimens.—EDS.

Curious Freak of Twin Steam Boilers.

To the Editor of the Scientific American:

I notice the communication of H. P. S. on page 356, current volume of your paper, and now submit the following:

Judging from the description given by him of his boilers, and the manner of setting them, also their feed water and steam connections, I assure him he has a most dangerous arrangement.

In his description, he asserts that even firing is maintained under both boilers at all times, and yet the same water level cannot be maintained in them—that the water level will rise and fall two and even three gages at regular intervals, first in one and then in the other boiler.

Now in regard to uniform firing, it is a feat impossible, even where both boilers are set in one arch and over the same fire, and it must become more difficult when set in separate arches, as in his case. The opening of the fire or furnace doors and the addition of fresh fuel cause a temporary change of the steam generating power of the fires—which change alone would be sufficient to produce the results mentioned, when considered in connection with his descriptions and surrounding circumstances.

The steam pipes leading from his boilers are too small in capacity by fully one half; and the two opposite currents of steam, meeting at the T, and the right angular turn of these united currents with no larger pipes, produce a great reaction and resistance to the steam, which would be avoided by using a steam drum of considerable capacity in place of the T, and taking it thence to the engine by a pipe of double capacity

As his water supply is admitted to the boilers through the same sized pipes as are used for the outlet of steam from them, and as the water in passing into or from the boilers has neither counter currents, contractions or short angles to overcome, it follows that the water in each boiler will more readily pass from one boiler to the other than the steam through its several obstructions; and consequently any increased pressure, caused by the temporary variation of the